Concrete

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Stripping Panels Without Removing Shores

By C. H. SCHWERTNER
Construction Superintendent, Turner Construction Company

Again we are able to pass along to our readers a complete description of an efficiently designed system of wooden forms. This time it is a system devised by a superintendent employed by the Turner Construction Company, the same man whose winter enclosure for silo construction was described in a recent issue. It has often been said that the profit or loss on a concrete structure depends largely upon the forms. Not only may money be saved on lumber and upon erection and stripping operations, but a really worthwhile saving comes from the reduction of cement finishers' time in remedying defects left from an inefficient mix, insufficient spading, or a poorly devised and constructed form system. The concrete work on this job appears very good. Honeycombing, fins, and sags were forestalled by good forms and by proper manipulation of the concrete. Building forms as if they were to remain a portion of the finished structure proved less expensive in the end than cheaper forms that would require many hours' time to be spent in removing defects. Perhaps the ideas told here by Mr. Schwertner would be worth trying on your own job. If anyone has a still better system we would like to know about it.—*The Editors.*

Note the clean sort of work disclosed after removal of the forms

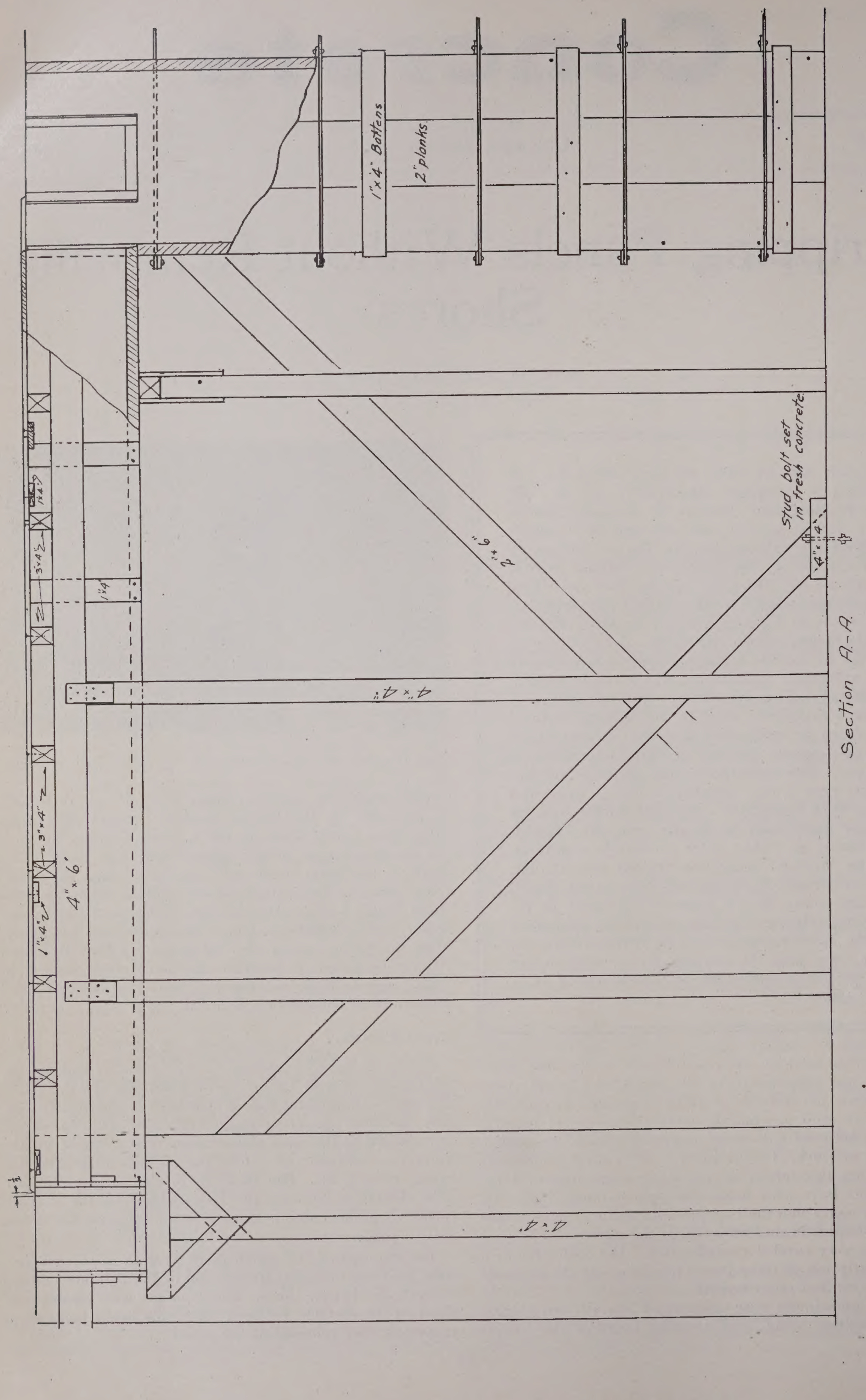
The forms used in the construction of the new office building and laboratory for the Portland Cement Association while not differing greatly from what is generally accepted as good practice do contain some novel features that it is believed will be of interest to those engaged in this class of work. The building is of reinforced concrete construction throughout having floors consisting of large rectangular bays with beams between columns only. As it was necessary that the best possible surfaces be obtained on the columns, beams and ceilings the questions of forms was given very careful consideration. The following is a brief description of these forms together with the methods used to erect and remove them.

The column forms were made up of 2-in. dressed planks, 1x4-in. battens being used to hold together the planks forming each side, and care being exercised not to let any of the nails in the battens project through the forms where they would show in the finished concrete surface. The beam openings in the columns were made to the exact depth of the beam form and 1 in. wider than the same. The reason for this extra inch in width will be described under beam forms. The separate sides were nailed together with doubleheaded nails to permit easy stripping. After the forms were assembled and erected steel column clamps were used to hold the forms together while concreting and until the concrete had finally set and hardened sufficiently to permit their removal.

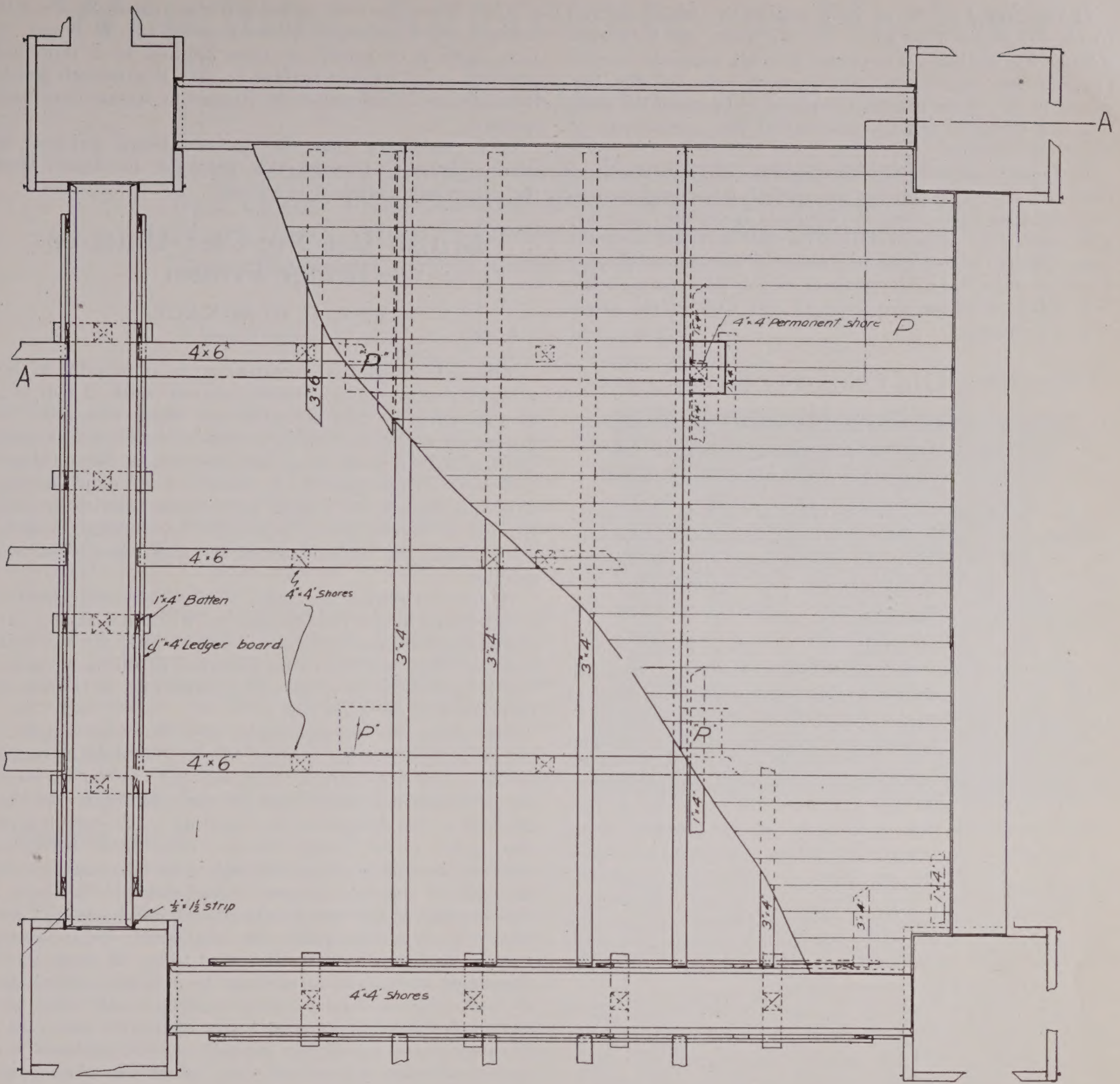
Beam Forms:

The beam forms consisted of 2-in. bottoms and 1¼-in. sides made up with 1x4-in. vertical battens. To these battens 1x4-in. horizontal ledger boards were fastened to support the floor panel system. Vertical ½x1½-in. strips were nailed to the ends of the beam sides to make up the difference between the cut in the column form and the beam form width. The function of this strip is to provide clearance between the beam side and the column form when the column form is removed with the beam still in place.

The floor panels of which there were three to each bay were made up of ⅞-in. dressed and matched lumber nailed securely to 3x4-in. joists. These panels were made 1 in. short of the distance between the inside beam faces so as to permit easy removal of the panels.



Elevation of one bay, showing the elements of the forms in place. This is shown as a sectional view, taken from the plan view on another page.



Plan of one bay, indicating the different parts of the forms system. Permanent shores are indicated by the letter P.

Erection of Forms:

The column forms were first erected to the exact height with respect to the floor above, and securely held in position by means of 2x6-in. braces running diagonally from the upper portion of the column to a block fastened to the floor. The manner in which this block is fastened to the floor is shown in the sketch. The beam forms were next hoisted into place. It was found that the beam could be held by driving one nail through the beam bottom into the column form. No wedging or keying was necessary for the smaller beams, while only a piece of 2x4-in. lumber, nailed to the beam side to prevent the column from spreading, was necessary for the larger beams. Shores were then installed under the beam forms. The 4x6-in. timbers cut to exact length were then laid on the ledger boards as shown in the sketch, after which the floor panels were laid down. It was found that these panels could be easily held by driving a few small nails through the panels into the beam sides. Shores were then erected under the 4x6-in. timbers.

Since floor forms as have been described are relatively expensive to build it was found necessary to devise means to quickly remove and re-use them without inducing dangerous stresses in the concrete. To accomplish this a system of permanent shoring was decided upon which would permit the early removal of the floor panels. This system consisted of providing four shores in each bay which remained in place together with a small piece of panel while the balance of the panel was being removed. These shores are referred to as "P" in the accompanying sketch. As the sides only of the beams were removed be-28 days no difficulty was experienced in providing support under them.

Removal of Forms:

The column forms were first removed. This was made very easy with the beams in place because of the clearance provided by the ½x1½-in. strip previously referred. Beam sides were next taken down after which the floor panels were dropped into ropes in order to prevent damage to them as much as possible.

It was found to be an easy matter to reduce column forms to proper size when moving them up to higher stories. To facilitate this matter a small portable electric handsaw was purchased, and made it easy for the carpenter to rip off the material required to be removed, since this saw operated quickly and called for a minimum of muscular exertion.

Particular advantages of this system of form construction are the small amount of skilled labor required to erect the floor forms once the columns are erected, the ease with which the column forms can be removed with the beams still in place, and the system of permanent shoring which permits the early removal of the floor forms without unduly stressing the concrete and without the necessity of reshoring.

Patching Old Concrete Pavements by New Method

By CHAUNCEY H. VIVIAN
Boulder, Colo.

Experiments by a western chemist have led to the issuance of patents to him on two new processes for repairing concrete pavement. The first pertains to the application of asphaltic tops to new or worn concrete bases. The second is a method for patching concrete with like material.

The virtue claimed for the new method of patching concrete with concrete lies in its reduction of the contraction of the concrete through the simple expedient of providing expansion joints.

Engineers versed in the subject state that a square foot patch of concrete will shrink approximately one-eighth of an inch in surface dimensions upon setting. It is commonly supposed that this contraction at the under surface which joins with the main body of the concrete being patched produces stresses and strains which tend to weaken the joint. Subsequent pounding of traffic then commonly dislodges the patch, either in whole or in part. Because of this failure to make patches adhere, no satisfactory method of patching has been known and badly worn concrete roads have had to be re-surfaced with black-top material or the worst sections taken out and re-built.

Under the new method, the patch is allowed to stand about 30 minutes after finishing. With a trowel, knife or some simliar instrument, gashes or cuts are then made in it, extending through to the old surface. These gashes are made in two directions at right angles to each other, thus cross-hatching the surface and giving it a checkerboard effect. Experience has shown that the squares should be roughly six inches on a side, or 36 square inches in area.

The theory of the method is based on the fact that the shrinkage lessens as the square of the reduction in area. That is, if a square foot patch is divided into four sections, the shrinkage will have been lessened by fifteen-sixteenths.

Careful cleaning of the surface to be patched is essential. In the setting of the original concrete, the union of the cement with the sand grains and pebbles causes the formation around the latter of a thin film of calcium silicate. As the chemical affinity between cement and calcium silicate is less than that between cement and silica, it is desirous to restore the original silicious surface of the sand grains and larger rock aggregate. This is done by cleaning with dilute muriatic acid, one ounce of 18 degree Baume being sufficient to cleanse two square feet of area.

The acid is removed by flushing with water. A thin emulsion of pure cement is then applied through the medium of a stiff brush which has a tendency to force it into the minute openings in the surface.

After the expansion joints have been made in the new surface, the concrete is allowed to set for 24 hours. A rich mixture of cement is then applied in a thin coat over the cross-hatched surface to give it a smooth finish. By that time, it is figured, the dangerous strains have been avoided.

It is necessary that the surface being patched be thoroughly wet, in order that no water be drawn from the new mixture while it is setting.

British Use Pre-Cast Units on Bridge Project

By A. C. BLACKALL
London, England

Although monolithic construction is admittedly a very valuable feature in reinforced concrete work, it can only be attained in its most complete and effective form by the deposition of the concrete in moulds, where it must remain undisturbed for some days until the cement has hardened sufficiently. Consequently, in order to avoid delays in construction, the pre-cast system has become popular in Great Britain of recent years, especially for bridge building work, where the convenience of the traffic has to be considered.

A very interesting specimen of pre-cast bridge work is to be found in the road bridge at Welwyn Garden City, a model town constructed on idealistic lines not far from London. This bridge crosses a branch of the London and North Eastern Railway about a quarter of a mile from its junction with the main line.

The abutments are of cellular type, the dead weight of the earth filling being utilized to give the stability which in mass concrete work is obtained only by an excessive use of valuable material, and the same principle has been adopted in the design of the retaining walls carrying the approaches to the bridge. As no centering or timbering could be erected over the railroad, it was decided to form the arch of separate pre-cast trough-shaped ribs, each 2 feet in width and intended to be placed side by side. These ribs were moulded while the abutments and retaining walls were being built in the usual way. As soon as the abutments had been carried up to springing level, the arch ribs—31 in number—and weighing nearly three tons each, were lifted by an electrically operated crane with a 90 foot jib, and swung into position over the railroad, this operation being carried through within nine hours one Sunday.

The arch having been thus rapidly completed, the abutments were carried up to their full height and tie beams were laid above the arch to link up the counterforts of the abutments, so as to take up the horizontal component of the thrust. The whole of the decking is also formed of pre-cast members, and it may be added that all these as well as the arch rib units are grouted together so as to conduce to monolithicity as far as possible. The bridge is 132 feet in length and 56 feet wide between parapets, the arch having a 20 ft. 4 in. skew span.

A contract for the construction of Puerto Plata-Santiago highway (Mexico) forty miles in length, has been awarded an American resident of La Vega, D. R. The Dominican republic began the road last year and completed about 30% of the work. The contract is based on the unit system and must be completed in eighteen months. Work is paid for by quantity, and the price per unit is said to be liberal.

The granting of this contract seems to inaugurate a new policy by the government, which hitherto has not been inclined to give contracts for public works.

Weighing Aggregate on Highway Project

Linn County, Iowa, Builds Pavement with Weighed Aggregate, Thus Gaining More Uniform Concrete—The Plant Used—How It Operates—Inspection Methods and Tests Reduce Cement Overrun

By A. F. MILLER
Resident Engineer, Iowa Highway Commission

Last year Linn County completed paving that part of the Lincoln Highway within its borders, leaving only one stretch of unpaved road in the 233 miles between Cedar Rapids and Chicago. The present construction continues an older pavement eastward 5.43 miles to the county line, connecting Lisbon and Mt. Vernon with Cedar Rapids, while another section of the same contract provides pavement for the 7.3 miles between Cedar Rapids and the county line on the west.

The unusual thing about the Linn County work is the method of proportioning aggregate. Instead of measuring the cubic feet of sand and stone per cubic foot of cement, as is common on most construction work, the specifications say that the concrete shall be proportioned one pound of cement to 1.71 pounds of sand and 3.34 pounds of limestone and that the amounts of each material per batch shall be determined by weight, with the proper allowance for any moisture in the aggregate.

Weighing Device

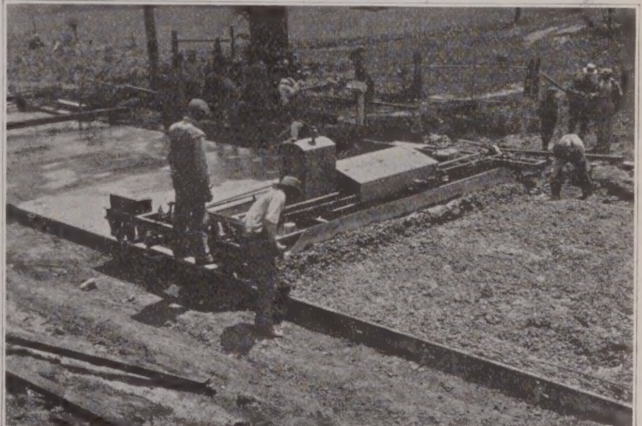
To carry out this requirement, the contractor purchased a special bin designed to weigh batches. The bin itself is the usual hopper bottom type, with a capacity of 75 tons. It is divided into two compartments, one for sand, the other for stone. One measuring box serves for both materials. It is hung beneath the bin on the short end of a scale beam which is connected to the weight beam of a platform type scale by a series of levers. On the end of the weight beam there is a hook on which the weights are hung, while the beam itself is graduated to pounds and has a sliding weight, just as in the ordinary platform scale. The weight beam is boxed in to protect it from the wind.

The aggregate weighing plant with a truck backing into position beneath it

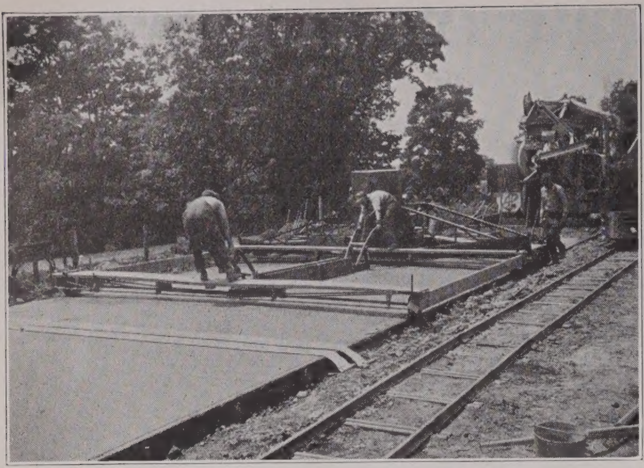
Material runs into the measuring box through a hole in the bottom of the storage bin. The flow is controlled by two valves, one for sand, the other for stone. The valves are trough shaped and are actuated by levers which hang down in front of the scale.

When a batch of material is to be weighed the scaleman sets the sliding weight for 35 pounds less than the total weight of sand for the batch, then opens the valve and lets sand run in rapidly until the scale beam rises. When that occurs he sets the scale for the correct weight and allows sand to run in slowly, by working the valve back and forth, opening it a little, then closing it again, until the beam just balances.

Placing center steel and steel for dowels and transverse reinforcing



The finishing machine doing its work



The longitudinal float, plus belting, that gives easy-riding qualities to the pavement. Used from bridges just behind the finishing machines

Adding the Stone

Since the stone is weighed in the box which already contains sand, the scale beam is next set for 85 pounds less than the weight of the total batch and stone is admitted rapidly. When the beam again rises the scale is set at the weight of the whole batch and stone is admitted slowly until just the correct weight is in the box. The whole weighing operation is so rapid it can be completed while a truck is backing into position under the bin.

Each batch is weighed so accurately that it does not miss the correct amount by more than a pound or about a double handful of material. If too much of either aggregate is accidently run into the measuring box, it must be taken from the truck with a pail and be weighed on a small spring scale.

The plant inspector of the highway commission forces determines the weights of material used per batch. To do so he must find how much moisture the sand and stone contain and add the weight of that moisture to the batch weight of each material. He must also find what per cent of material in the coarse aggregate will pass the ¼-inch sieve and alter the weights so that this fine material is counted as sand. Batch weights are not altered unless a change of at least 5 pounds is required.

Job Laboratory

So that he may carry out the necessary tests, the plant inspector is provided with a small oil stove on which to dry samples of material, a set of Tyler sieves, a small balance and a large spring scale.

Moisture tests are made from four to six times a day, sometimes even oftener if previous tests indicate considerable variation. A complete sieve analysis is made once a day and the amount of coarse aggregate which will pass the ¼-inch sieve is determined every hour.

At least once a day the batcher scale is checked by hanging standard iron weights on the measuring box. Many times a day it is checked for balance at zero load.

The inspector at the mixer controls the quantity of mixing water, which is measured in a 3-valve pressure tank. The quantity of water running into the mixer is regulated by a lever which raises or lowers the end of the outlet pipe inside the tank. A dial indicates the quantity of water which will be discharged into the mixer for each position of the outlet pipe. Before work commenced the calibration of this dial was checked by actually measuring the water discharged at each position. Three trials were made for each measurement indicated on the dial and it was found to check almost exactly.

Test Cylinders

Once a day the road inspector selects a batch of concrete from which he makes two 6x12-inch cylinders which are later sent to the laboratory for test in compression. The slump of the concrete is determined before it is put in the cylinders and the location of the batch is described in the inspector's notebook so that cores may subsequently be drilled which will show the strength of that batch in the finished pavement.

From the same batch the road inspector takes a sample of concrete from which he washes the cement, being

Cleaning and baling the empty cement sacks

Closeup of the same longitudinal float

Slump tests and compression cylinders tell the story of the success of the methods

careful to retain all the aggregate. The aggregate is then sent to the plant inspector, who dries it and determines the proportion of fine to coarse material by testing it with the ¼-inch sieve. Once a day the road inspector catches a sample of concrete as it comes from the mixer and sends it to the plant inspector in a covered tin pail. The plant inspector dries a 10-pound sample of this concrete to determine the amount of water it contains.

Most of these tests are made to learn just how weighing affects the uniformity of proportions of fine and coarse aggregate and to see how the strength of individual batches varies. Reports to date on the results of these tests indicate the success of weighing as compared with volumetric measurement.

Sieve analyses of the samples from which the cement was washed showed fine aggregate ranging from 30.0 to 37.5 per cent. The average variation has been 4.0 per cent as compared with an average of 13.4 per cent for 1923, the last year materials were measured by volume.

Cement content has ranged from 0.5 per cent above to 2.0 per cent above the amount theoretically required, the average being an over run of 1.3 per cent. From 1920 to 1923, when materials were measured volumetrically, the average over run on 41 jobs was 2 per cent.

The fine aggregate ordinarily contains from 2 to 4 per cent of moisture and the coarse aggregate 1 per cent. Occasionally, after a heavy rain, the material in the bin contains more than that amount, but even heavy rains do not affect the moisture in the storage piles very noticeably. The maximum moisture in the sand shown by any test was 4.3 per cent and the minimum 2.5 per cent.

The moisture content of the mixed concrete ranged from 7.0 to 8.5 per cent of the concrete, by weight.

From the standpoint of both engineer and contractor the substitution of scales for the old volumetric measuring box has been an unqualified success.

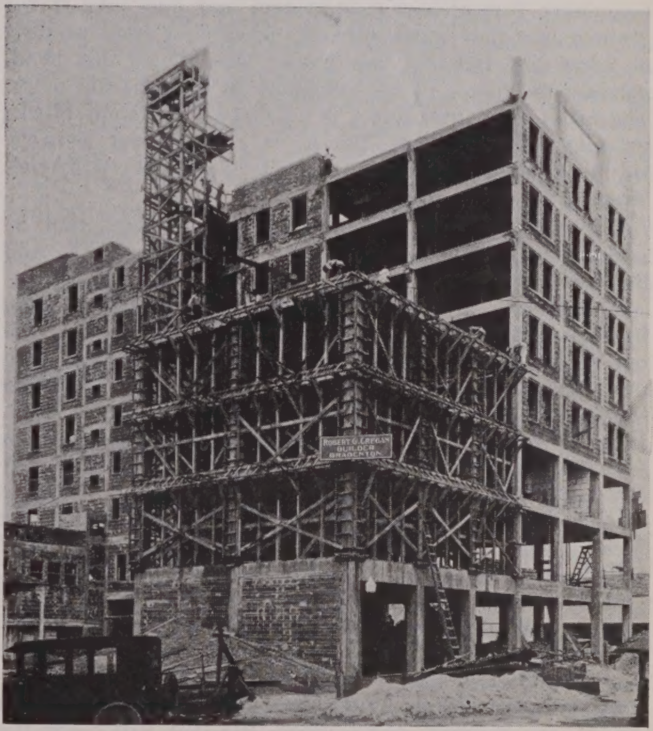
Introducing Skeleton Structures in Florida Town

Northern methods of erecting reinforced concrete skeleton structures are being introduced at Bradenton, Florida, by Robert G. Cregan, who recently moved into that city from Chicago.

An example of his work, the first building of its kind in that section, is the new "Hotel Dixie-Grange" now under construction in Bradenton. This will be an eight-story fireproof structure, with a structural frame of reinforced concrete and curtain walls of tile, faced with brick and terra cotta on the first two and one-half stories and with stucco on the remaining stories. Partitions are of gypsum tile.

The floor slabs were formed with the aid of removable pans, while ordinary forms were used in erecting columns and girders. The concrete was mixed in an Ausco 7-S mixer, hoisted by a 40-h.p. Novo hoist in an Insley bucket, and distributed from the tower by means of Insley chutes. An average of 110 yards of concrete was needed for each floor, and this quantity was poured in 10 hours, with a progress of a floor a week.

The building was designed by Frank A. Winn, architect, of Tampa.



Here is the first 8-story reinforced concrete building to be erected in Manatee County, Florida, now under construction

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Secretary of Agriculture Jardine recently announced the apportionment of $73,125,000 to the states for use in the construction of Federal-aid roads, for the fiscal year beginning July 1, 1926. New York, Pennsylvania, and Illinois, respectively, lead with amounts over three million dollars. The roads included in the system are the most important in the country and reach directly or indirectly every city of over 5,000 population.

The construction of an arterial road from Liverpool to Manchester, twenty-eight miles long and one hundred feet wide, at a cost of $14,520,000, is being planned. The road will have a concrete base with asphalt or stone surface and will run close to but not through important cities.

Advertising Your Products at Low Cost

To Sell Concrete Products in 1926 They Must Be Advertised — Plan a Campaign to Fit Your Merchandising Needs—Apply Common Sense and Well Known Advertising and Sales Principles—Keep Everlastingly at It—A Typical Plan

Concrete products must be sold in 1926. We have told you that already, and the fact is recognized by the majority. The average manufacturer admits the necessity for a selling campaign, but sometimes he has but a hazy idea of how to go about it. Perhaps this text will show him one way to do it. It is a general sales plan developed for a specific hypothetical products plant in the average town.

The products manufacturer, first of all, must forget that he is only a manufacturer. Manufacturers in other lines have forgotten that long ago, and now take it for granted that they must not only produce a good product at a low cost, but that they must above all get that product into the hands of the consumer at a profitable price. The products manufacturer is not only a maker of blocks or other concrete units, but he is a distributor as well. He must think of himself as a material dealer—a promoter of good construction.

We will assume that he has a good product, that he watches his quality and keeps it uniformly high, and that he keeps his production costs at a minimum.

The first thing that he must do, even before he goes into quantity production, is to sell his products. Not only must he sell them for foundations and garages, but must sell them for houses, flat buildings and for other structures where they are permitted by the local code. He must forget about individual units and sell a wall in place. He must tell the builder and the prospective owner that he can furnish a fireproof wall for so much a square foot, and not units at so much per unit. He must sell the idea of this better and cheaper construction. He must sell Suction, Ease of Laying, Uniformity of Strength, Uniformity of Color, Uniformity of Size and Shape, Speed of Winter Work and the other advantages of the unit. He must think of himself as a salesman of better construction and not as a salesman of units alone. He must not stop here, but must sell the steel sash that will be set into his wall, the concrete tile that will cover the roof, the metal lath that must keep the plaster from cracking, the cement and aggregates that will go into the floors and walks, the reinforcing that will go into the reinforced concrete of the building, and the stucco that will go on the wall. He is the material dealer of the future—making some of his materials and buying the rest. He is the salesman of the fire-safe home of the fire-safe age. But first, to sell others, he must be himself sold upon his own importance and the worth of his materials.

Put Economics to Work

But direct personal sales, following up the sort of leads that the material dealer follows up, is not the whole battle. He must be ready to compete in price—not only with other products men in his territory, but with the purveyors of other materials as well. The welfare of the entire industry depends upon an open price competition where quality of product is assured. This may mean fewer and larger plants and quantity production, but the industry must come to that eventually. The good salesman will admit the fact and make his plans accordingly. The day of the backyard plant, where units are made "by guess and by God" and where the matter of sales is left largely to luck, is past. The industry is getting on a par with the greatest, and the merchandising plans of the industry must grow in like degree.

Part of selling is advertising. Upon a good advertising campaign rests the effectiveness of personal solicitation. The average firm can formulate an effective plan that will include three kinds of advertising, yet the cost may be kept low. Returns will more than warrant the expenditure provided that the plan is well-devised and well executed. The three kinds of advertising that may be used are Outdoor Advertising, Newspaper Advertising and Direct-by-Mail Advertising.

The formation of such a plan was well expressed by Bert Wheeler, advertising manager of the Marquette Cement Manufacturing Co., at the recent annual meeting of the Wisconsin Concrete Products Association. The case he assumed is an average one, the plan effective and the cost but little. It is one that, in general, has brought real results for more than one products producer, and one that should bring results for others. In brief, this is the plan that Mr. Wheeler submitted.

The Average Plant

Let us assume, he suggested, a city of 25,000 population, of which there are a great many throughout the country. A plant, operating in this city, is making 200,000 units annually. If sold at 20 cents each these will give a fair margin of profit over cost of production, overhead and selling expense. How much should be spent on advertising these units?

For a specialty of this kind an advertising appropriation based on 3 per cent of gross sales could be considered a reasonable expenditure, which would give $1,200 in this case, or a little over ½ cent per block.

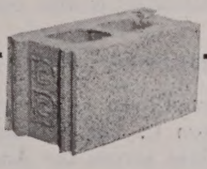
The market itself determines the wisest way to spend this money. There are three factors, each or all of whom may decide a sale. The architect specifies materials, the contractor makes the purchase, partly on a price basis, subject to the approval of the architect, and the owner tells both what he would like to have, within the limits of his appropriation. These three factors must be influenced by the sales or advertising plan.

It can probably be safely stated that the first two prospects must really be sold personally, and they will be interested in your advertising only as it is directed to the building public. They are interested in the demand that you create by your advertising, since this improves their own business. It is therefore necessary to aim your *advertising* at the ultimate consumer, or the owner. This is intended to not only obtain direct sales, but to influence the large buyer as well—the builder.

The public is but little interested in your own business, your product or your efforts. In your advertising, whether it be personal letters, form letters, direct-mail or newspaper copy, write to interest him not in your product, but in your product as a means of getting comfort, economy, fire-safeness and beauty in a home. He is not interested in the *unit*, but is interested in what *it will do.* You can talk to him, in your copy, of your ability to serve him and possibly close with the most technical discussion you can think of, getting across to him the idea of a scientifically manufactured product. But a better idea is to name the brand of cement used; not that he knows one cement from another, but the advertising of the cement companies has created an impression of quality, in the public mind, such as has been created by the advertisers of "Fisher Bodies" in the automotive field. "Made of ——— Cement" may be used by you just as effectively as "Body by Fisher" is used by the automobile manufacturer.

How Spend the Money?

Now that the market has been analyzed, it is time to decide on how to best spend the money, the $1,200 decided upon. The question of *when* to advertise may be answered with the word *constantly*, since men build all the year round. The greatest volume, however, occurs in the spring and fall, so extra effort should be used at those times. In this day of automobiles the prospective builder travels far looking for a building site. Isn't it reasonable, then, to assume that outdoor advertising stands a good chance of reaching many prospective buyers, especially when posted in the vicinity of real estate developments? The first item on the appropriation being discussed would then be about twenty road signs, costing about $200, or about $10 each. These might show a perspective view of a block at the top, so as to present an irregular shape that will readily catch the eye, and then contain copy somewhat as shown on this page.



Concrete Homes for Economy and Permanence

Builders Concrete Products Co.
Phone 1001

Then there will be signs put on the delivery trucks, costing about $20 each, again advertising the firm and the products. Another good place for some effective signs is on the work where the products are being used. One hundred job signs, costing not more than $50, will then bring up the total expense for outdoor advertising to $270 all told. This will not include the big sign erected or painted on the plant itself. The aggregate silo, standing up above the other buildings as it does, will make a topnotch place for just such a sign. All this is purely institutional advertising, but the architect and the contractor will see this and know that you are on the job.

Direct Advertising

Now comes the advertising that will directly get prospects and customers. There should be one promotional testimonial and illustrated booklet to be sent to people who are known to be about to build, and to those who are buying real estate, and to those who are getting married, unless they are known to have insufficient funds to permit their building a home. These booklets should be attractive and well printed, even though they will cost as much as 20 cents each; $200 spent on a thousand of these will be plenty to start on. Then these could be followed up by small photographs or postcards of new houses as they are built, writing illustrated form letters or personal letters to these and other prospects. It will be possible to carry on quite an extensive direct-by-mail campaign in this manner for not over $300 more, or a total of $500 for direct-by-mail advertising.

Now as to newspaper advertising, there is good value in the local paper. Select the paper that is the most carefully read and that has the best circulation. Where there is but one paper in the town there remains no choice. The building page that they run on Saturday would be fine for some ads, but other pages should be used from time to time. Editorial mention might be secured whenever a big job has been secured, if the information is sent to the editor. The rates on the paper may be 5 cents a line, or 70 cents per column inch. An ad six inches deep on two columns will cost $8.40, or $252 for thirty insertions. This will give space for an effective border which will stand out better than the usual newspaper rule border, and room for a little illustration and about ten lines of copy, and a snappy signature, and still leave plenty of white space so the ad will not look crowded. The thirty insertions will allow for an ad every week in the spring and fall and about every other week in the winter and summer months. This appropriation will then allow about $48 for cuts and art work, and will give a total cost for newspaper advertising of $300. That makes $1,070 altogether, and allows $130 for contingencies, such as a prize for a guessing contest, space in the Church Program and the County Fair Annual and tickets for the Policemen's Ball, and whatever else calls for a little money. Then, when other demands come up that you really don't want to meet, you can say that your appropriation has been used, for now you have an effective advertising budget and everything is provided for in advance.

Advertising Service

Some money can be saved by calling on the Concrete Products Association, the Portland Cement Association or the manufacturer of the cement that you use. Some of them have signs that would be just the thing, or could even make up special ones cheaper than could be bought at home, and they have newspaper cuts and border designs, too, that are effective. They could help, too, by sending literature and booklets that could be sent out to the prospects. It would be well to see just what they could do to help. Then put this advertising into action, and keep everlastingly at it. A man buys but one house in his lifetime, ordinarily, but new people are always getting married or moving into town, and there will be plenty of chance for the campaign to keep bringing in the business.

If you are making 200,000 block this year, next year you will have to make 300,000, if you get out and sell that many. Your advertising campaign can, in the long run, bring in handsome profits. It's good insurance for a successful and profitable future. A plan like this is a good one. Would it fit your market?

When Mr. Wheeler worked out the above scheme he accomplished something that will be of value to every producer, not only in the state association at whose convention he presented it, but to others who read about it in these pages. He is certain that some such campaign would be beneficial. We present this solution for what it may be worth.

Concrete Successful in Construction of a Storm Resisting Sea Road

In the construction of a sea road at Torquay, Devonshire, England, the Borough engineer adopted an effective method to overcome the battering of severe storms to which this part of the coast line is subjected at quite frequent intervals.

The original surface was of waterbound macadam, which had suffered considerably from a constant stream of motor traffic and from heavy seas in time of storm. Owing to the great camber on the macadam the excavation necessitated the removal of practically the whole of the metalling so that for a large portion the filling of the road, mostly of a soft nature, lay bare. The greater part of the excavated material was screened and used again in the foundation which together with clean metalling was consolidated to a minimum depth of three inches. After thoroughly wetting the foundation, 5:1 concrete was laid. The aggregate was local limestone and sand.

The supply of stone being greatly restricted the contractor had to accept delivery of unscreened material and since the screening on site took much time the material was used as delivered. The original proportions specified were:

One cement, one gravel, two sand, two broken limestone to pass two-inch screen.

As unscreened material had to be used the proportions were modified to: One cement, two sand, three unscreened limestone up to 2½-inch gauge.

No. 9 B.R.C. Fabric was laid 1½ inches to 2 inches from the bottom of the concrete, the side laps being from four to six inches and the end laps approximately two feet. The first portion was laid in alternate bays and necessitated the work being done in two courses. Afterwards the continuous method was adopted which resulted in quicker working, the material being more easily brought from the mechanical mixer.

Upon the completion of the concreting the surface was treated with three coats of sodium silicate of the 3.3 ratio.

The road was open for traffic eight days after completion and up to the present, six months after completion, nothing in the nature of a crack, not even a hair crack, is visible. Approximately six hundred yards were treated this way on an average width of 21 feet. Henry Garrett, the Borough engineer, reporting following the winter gales and stormy weather, says: "We have recently experienced some tremendous gales. The heaviest gale took place on top of the spring tides and great waves dashed over the road, carrying with them large boulders and washing away large quantities of the foot of the cliff, but on inspection immediately the road became passable, I found not the slightest trace of any damage anywhere along the whole length of the road."

A.A.E. Makes Changes in Organization

Revision of the basic structure of the American Association of Engineers in accordance with the demands of the members as expressed in a recent referendum was the outstanding result of a meeting of the Board of Directors at Chicago recently. A referendum of the membership resulted in a vote of more than four to one in favor of separating national and local dues in the organization and other questions designed to reduce operating costs and promote a maximum of self government and efficiency within the organization.

Another basic charge was in the elimination of grades of membership as used by technical societies which grades, in the judgment of the board, were not suited for a professional organization devoted to engineering welfare work such as the American Association of Engineers. Three classes of members are now provided for: Member and Affiliate with dues at $7.50 per annum each, and Junior Member (which includes former Student Members) at $2.00.

The new program contemplates a nation wide survey of the supply and demand of engineers to be carried on in cooperation with other national bodies; an enlarged placement service for engineering employees with district offices in various cities is also contemplated.

New Concrete Dam in Maine

The Central Maine Power Company has placed a contract with the Morton C. Tuttle Company of Boston for the building of a dam across the Androscoggin River at Gulf Island. This development is located five miles above Lewiston, Maine.

The Androscoggin River will be held back by a 50 foot concrete dam, with power house located on the Lewiston shore. The development will generate 27,000 horsepower. It is claimed this will be the second largest power development in Maine, exceeded only by that at Rumford Falls.

A short branch line railroad will be built so that freight cars will move directly to the site of the job. Work on this road is to be started immediately and the whole operation will be pushed through to an early completion.

This is the first big development undertaken by the Insull interests, who have recently purchased control of the Central Maine Power Company.

Replacement of stone pavements in Dublin with reinforced concrete, asphalt, or wood is planned by the Dublin City Commission.

A £250,000 program of sewerage extension is about to be embarked on.

Improvement of public highways in the Yungas Valley near La Paz, Bolivia, will be carried on with the income received from new tolls and changes in the tolls already effective on the Quime Highway. An American construction company is negotiating with the Bolivian government for this work.

Testing a 300-ft. Concrete Chimney

Fundamental Data for Chimney Design Against Wind Pressure and Temperature Changes

By BENJAMIN WILK

In designing a reinforced concrete chimney for the Duluth plant of the Universal Portland Cement Co., the engineering department was afforded an opportunity for outlining a series of tests which would develop as much information as possible on the effect not only of heat but also of wind on chimneys.

Tests outlined include (1) temperature gradient through the lining and wall of a reinforced concrete chimney; (2) nature and intensity of stresses developed in concrete and steel reinforcing due to wind pressure upon the chimney and as a result of flow of heat through the wall; (3) wind velocity adjacent to the chimney; (4) distribution of the pressure developed on the cylindrical surface of a chimney by wind forces; (5) nature and extent of the deflection of the chimney due to the wind pressure and heat.

In studying the temperature gradient through the lining and wall of the chimney, and in order to determine the flow of temperature through the concrete, 30 thermocouples were placed in the chimney.

In determining the nature and intensity of stresses developed in the concrete and reinforcing steel as a result of flow of heat through the wall, and due to wind pressures on the chimney, gauge points for strain gauge readings were set at certain points in the chimney. These gauges can register a movement of 1/50,000 of an inch in a length of 8 ins. or 1/400,000 of an inch per inch. It was intended to take strain gauge readings (a) before the chimney was heated to determine the stresses while the chimney was free from internal stresses caused by the heat; (b) while the chimney would be heated to gain information on how the stresses developed as the heat rises; (c) at stated intervals after a constant heat condition exists to determine the effect of both the internal and external forces on the chimney. These measurements would also be taken during times of high wind.

Wind velocities as well as wind pressure adjacent to the chimney will be determined with the aid of integrating impact pressure tubes. It was decided that pressures should be secured for two distinct reasons: (a) to determine the nature of the action of wind on a cylindrical surface. Tests on small models show that a positive pressure is exerted on only a small proportion of the cylindrical surface, approximately 35%, while a negative pressure or partial vacuum exists diametrically opposite. This theory is not yet used in the design of towers and chimneys, but it is agreed that definite information on this subject on a chimney 300 ft. high would show the relation between coefficients as determined on a small model and on a large structure, and the data would be a distinct addition to scientific knowledge.

(b) Because data on wind and pressure as secured coincident to data on the stresses on concrete and steel reinforcing would effect an accurate solution of the problem.

The nature and extent of deflection of the chimney due to wind pressure will be determined by means of a telescope and mirror on an isolated foundation on the ground 44 ft. from the base of the chimney, and a steel horizontal plate 16 in. square set out from the chimney near the top. The telescope being rigid, any movement of the chimney and a checkerboard on the plate will be read on the mirror.

Readings will be taken during the next 12 months and it is expected that a report will be ready in 1927 giving conclusions as to the temperature gradient through the chimney wall, as well as data on the wind pressures that will be fundamental in the design of chimneys.

Extracted by permission from a paper delivered at the 22nd Annual Convention of the American Concrete Institute.

Wisconsin Products Men Hold Distinctive Meeting

Few state products associations have been as successful in the past as the Wisconsin Concrete Products Association. Certificates of quality are not only held in high esteem by the producers of that state and are the open sesame to many a buyer's door, but they seem to be in the possession of a goodly number of the producers of the state. The state branding law, too, has caused the manufacturers to "grademark" every unit leaving the plant, and no man is going to put his name on a unit that will not do him credit.

By scientific proportioning they are increasing the strength of their units and at the same time they increase the yield per sack of cement. Fineness modulus is in the language of almost every one, and it will not be long before the matter of water-cement ratio will be a common topic at their meetings.

The meeting last month was opened by Dave Armitage, president of the Wisconsin League of Building and Loan Associations, who stressed the importance of a strong association. He brought out the fact that the state contained about 400 products plants, but that only about 60, or 15%, belonged to the association. These 60, however, he announced, now represent over 50% of the total production.

Several important ideas were expressed by the president, C. O. Gochnauer, in his response to the opening address. He declared that the country is on the threshold of the age of masonry homes, and that concrete units have become the best material for this purpose that money can buy. Quality must be maintained, he insisted, and admitted that the present Wisconsin building code would go far to insure quality units. Cement mortar is necessary, according to his ideas, for a lime mortar in his opinion does not afford the needed strength or permanence. He suggested that the equipment manufacturers would render good service by advising their customers as to what repair parts should be carried in stock at the plant, and thus obviate costly delays while waiting for a spare part to be shipped from a distant warehouse or the factory. Another good suggestion made by him was that a complete roster of members and their products be supplied to every member in order that inquiries may be readily passed along to those making the required product. He expressed the necessity for every member to work for more favorable insurance rates in line with the fire rating issued by the Underwriters' Laboratories.

Then followed a talk on successful marketing methods, presented by A. J. R. Curtis of the Portland Cement Association. He spoke of the difficulties of merchandising concrete products and stressed the necessity for a good product. He cited the importance of the various requirements, such as the American Concrete Institute specifications, and laid down six points of manufacturing efficiency that must be taken care of to get consistently good products. These, he claimed, are Gradation of Materials, Amount of Water, Cement Content, Time of Mixing, Casting Efficiency and Curing Efficiency. These things controlled mean uniformity of product. The best selling points of block and tile he listed as uniformity in strength, shape, weight, color, suction and absorption. The latter measures density, strength and weathering ability. When stucco is to be applied a uniform suction is particularly important. He then stressed the necessity for a specially well planned method of selling architects and told how it was necessary to approach them in a different way than would be used in making friends among the contractors.

Then came an interesting talk by Bert Wheeler, of the Marquette Cement Manufacturing Company, who presented a hypothetical advertising budget. He was followed by Peter Brust, architect, who told the products manufacturers a lot of reasons why so many architects refuse to specify concrete units. In the discussion that followed his talk it was soon demonstrated that the situation came from the failure of the association to keep the architects in touch with the advances in production methods, and it resulted in a determination to educate the architects on the nature of modern concrete products. The matter of dark color could be met to the architects' satisfaction, he was informed, simply by choosing light aggregates and light cement, and the uniformity of color simply by supplying every part of a job from the stock of any of the good sized plants. The matter of shrinkage that he brought up was found to be mostly a matter of curing, and unusual shrinkage, he was told, was merely a matter of the contractors purchasing block that were too green. Strict curing requirements were thought to promise the best solution. The rockfaced block that he so heartily condemned as being not only ugly but an imitation of a stone facing that is no longer ever used with natural stone was one matter that brought about considerable discussion. Natural treatments were recommended. Mr. Brust left his hearers with the admonition to improve their products and regain lost prestige, by means of demonstration and education, before expecting architects to universally specify their material.

Then came a further discussion on the subject of merchandising concrete products, presented by W. D. M. Allan, of the Portland Cement Association. He claimed that anyone could make good products, since the manufacturing problems are very simple, but that the most important thing is merchandising. By merchandising, he means selling in such a way as to lead to further sales and to repeat orders, and to good will.

The first day's session was concluded with a very successful banquet and evening's entertainment.

The following day was devoted to discussion of various plant problems and to papers on building code enforcement and upon methods of expanding the concrete products market. The latter talk, by John Powers, president of the Illinois association, proved of importance and will be given in full in our pages. Mr. Powers stressed the importance of a clean plant, a good product, real salesmanship and a real merchandising policy.

During the session devoted to plant problems, one item of interest was the matter of plant layout. Several different schemes were outlined, and the impression was gained that a great deal could be saved by elimination of unnecessary handling of aggregates. The use of steam jets to thaw out cars of frozen aggregates was described by several.

The idea of proportioning for strength and economy was discussed, and it was the opinion of several members that the proper use of the fineness modulus method, plus careful attention to water content, is very desirable from the standpoint of economy.

The feeling is growing that the small mixer is not the right thing for any plant. The use of larger mixers would permit an extension of the mixing time, to the benefit of strength and consistency, without holding up the machines. One delegate suggested that a combination batch and continuous mixer would have to be designed for products plant use.

In making face block it has often been the experience of manufacturers that the facing material will tend to stick to the face plate, especially in cold weather. One producer present at the meeting had solved the situation by nickel plating his face plate and then mounting a five-jet gas heater under it. Another had soldered two heating elements taken from electric irons to his face plate, and connected these to the lighting circuit. This, too, seemed to solve the problem, even on rock faced block. Another man keeps three face plates going, one on the machine and two being heated on the stove, and switching around whenever necessary. The nickle plating was not thought to have done much good of itself. In any case the heat must be so adjusted and governed that it will do its work without robbing the block of any of its moisture. The block should come from the machine fairly warm to the touch.

One manufacturer told how he installed a portable electric blower in his steam kilns to keep the air circulating. It was found to be very useful in drying the units after curing in the live steam.

Another delegate then brought up the question of collections, and told of the plan being tried in Sheboygan, where the material men have all agreed to furnish lien notices on all work where contractors have not paid cash on delivery. Sixty days later, if the bill is not paid, they file a lien with the owner, who sees to it that the bill is paid. The lien notice is filed without delay, and as a matter of routine. The contractor must give the owner a lien waver on every purchase of materials before getting his money from the owner. This system, worked through the banks, has so far proven very satisfactory, and is not objected to by the honest and responsible contractor.

At the annual election of officers, the past president, C. O. Gochnauer, was re-elected to succeed himself. A. P. Kuranz was elected secretary and treasurer, and A. W. DeVos was elected vice-president. District representatives elected at this time are: Chris Olsen, Julius Sorenson, George Leuty, I. J. Westerveldt, George Kahler and F. W. Zilisch. The secretary's office is at 425 East Water Street, Milwaukee.

The Davenport Lumber and Supply company will establish a plant at Davenport Terminals, Florida. The plant will be divided into an office, cement storehouse, concrete manufacturing department, and woodworking division. The company will install machinery for the manufacture of cement products, etc. The company also contemplates building about 10 houses.

EDITORIALS

After the Snow Melts—What?

March is a month of Spring—and the month of getting down to business. The frost is leaving the ground and the few snows readily melt under the rays of the warming sun. The winds blow from the south and the conventions are mostly over. The spring bidder resurrects half-used pencils and sets about sharpening them to a needle point. The spring rush is about to begin. What are *you* going to do about it?

Now is the time, if you have not already done so, to get out all that held-over equipment and see if it is fit for another job. You will be surprised—just as usual—at the number of bearings the men forgot to grease last fall, at the amount of flint-like concrete that clutters up the mixer drum, and at the yards and yards of haywire that hold things together after the last busy season. Survey your equipment yard with a critical eye. Put the men to work fixing up usable machines, and junk those that are of no use. Figure out what new equipment needs to be purchased—and then see the equipment man at once. Take stock of your tools and replace broken ones. See that everything is ready for instant use. Know what you have and make certain that it is in good condition. You will need that information on your very first bid.

Better check up on materials and labor, too. Things may have changed while you were away—and March brings many changes. You will soon be back to work, unless you saw the advantages of winter construction. It's going to be a big year.

The Road to Profit

Three organizations met in one week. The American Concrete Institute, the American Concrete Pipe Association and the Concrete Products Association, all brought before the eyes of the industry many things that are good to see. Those healthy triplets—science, production, merchandising—were under discussion. Their application to the financial success of the concrete products industry, through the three organizations, has already caused phenomenal growth. The industry is beginning to find itself.

Problems relating to the first two are being solved, and these solutions are helping solve the problems of the third. Without good products, and plenty of them produced at a low cost, no profit can come through merchandising. That fact stands pre-eminently as a motive force behind the recent meetings. But an equally salient fact is that the science of mixing is not enough. The science of selling must be used energetically to dispose of the fruits of production. With sound merchandising policies, and with production costs and overhead reduced materially by means of a consolidation of production and by means of a better use of scientific principles of grading, proportioning, mixing and casting, it should soon be possible to produce a plentiful supply of better units—and yet sell them profitably at a cost so low that other masonry materials would not be able to enter into competition. As soon as that day comes, just so soon will the industry come into its rightful heritage. If the present organizations can bring this about they will have justified their existence.

Workmanship

It is interesting to observe the daring of some European designers of reinforced concrete structures. Should our own engineers attempt to call for such slender columns, shallow beams and thin arches, they might be considered, to say the least, a little "queer." We have had our troubles even with the more massive structures to which we are addicted, and our authorities would look with disfavor upon plans calling for designs like some that are to be seen abroad. Yet the fact remains that the "impossible" has already been done elsewhere. Why cannot we do as well over here?

Are we just a little behind in the matter of design? Are we erecting excessively heavy structures because lighter and less costly ones cannot be erected with safety?

Do the more economical and efficient structures of European designers retain their integrity under heavy loadings because European materials are better than ours? We cannot help but feel that our cement, our aggregates, and our steel are second to none.

Are there any mysterious properties of materials, known on the other side, that are unknown to our designers? In this day of open discussion that would be highly improbable. Is better workmanship possible in Europe, and does this fact make it possible for the owners on the other side to obtain more efficient structures? Cheap labor may make that possible, but our American machines should be able to put us somewhat upon an equal basis. Do they work on a low safety factor over there? If they do, perhaps our own safety factors could be materially reduced under conditions of better design and workmanship.

Efficiency grows from knowledge, but only when that knowledge is applied. In an efficiently designed and well built structure nothing but problematical loadings due to unforeseen occupancy need be left to chance. If construction is good, if the concrete is always at least as strong as the design calls for, if steel would be always accurately placed, then the designer need not call for extremely high strengths in order to allow for slipshod work. Accurate knowledge, applied to design and construction, need leave nothing to guesswork. With nothing uncertain, there need be less assumed excess of strength.

A changed attitude toward construction will be required before America may hope to approach the state of progress observed in parts of Europe, and before American designers will be able to give us reinforced concrete structures that will be the ultimate in efficiency and economy.

Our contractors must avail themselves of present opportunities to gain information that will make possible a more efficient mix and a stronger structure. They must co-operate with the architect and the engineer to the end that designed-for strengths will be consistently attained and exceeded.

Our equipment manufacturers must continue striving for better and more efficient equipment in order that the finest workmanship may be made possible with our high-priced labor.

Then, with our better ability, our codes must be revised to permit more efficient construction with the attendant lowering of costs.

In that way only lies progress.

Seven Years of Job Control

Experience with Job Control of the Quality of Concrete Has Taught the Reliability of the Water-Cement Ratio Method and the Importance of Controlling Every Element Entering into the Concrete

By RODERICK B. YOUNG
Senior Assistant Laboratory Engineer, Hydro-Electric Power Commission of Ontario

The author reviews the facts that since 1917 the Hydro-Electric Power Commission of Ontario has been interested in better methods for the production of concrete, having been confronted at the beginning with a large construction program and at about the same time having decided to abandon the practice of stating the quality of concrete in terms of its proportions, substituting therefor a classification based on compressive strength at 28 days.

After studying early methods of proportioning, the first field application of control of concrete was made on a relatively small job known as the High Falls development. Other applications were made to the Nipigon development, where an opportunity was afforded to study the other factors entering into quality control of concrete; that is, the control and handling of materials, mixing plant operation, placing and curing, the conclusion being reached that the design of the proportions was only one step and possibly a minor step in the production of quality concrete; to the Chippewa-Queenstown development where an important outcome of preliminary work was the decision to change the manner of stating water-cement ratio from a ratio of volumes to a ratio of weights.

At Nipigon, in 1920, it was found that the mixture could be entirely controlled by regulating the water content and that only occasionally did conditions arise requiring readjustment of the basic proportions. This was further confirmed by the experience in 1921 which showed further that when changes in the mixture did become necessary they could be made in the field without recalculating proportions, by restoring the mixtures to their original consistency, adding or omitting cement and water as required to maintain the water-cement ratio for the class of cement in hand.

Water-Cement Ratio

A careful study of the question of the existence of a water-cement-ratio-strength relation led to the conclusion that such a relation was a practical basis whereby to proportion concrete mixtures. The study showed the variations to which it was liable and the limits under which it could be applied.

Fineness Modulus

From the investigations of fineness modulus and surface area methods of computing proportions, it was evident that in using these factors both cement and water were proportioned, although only one was calculated.

Quantity of Fine Aggregates

Two important points are brought out by the investigation on the economies of concrete mixtures. The first is that for each combination of fine and coarse aggregate there is a ratio for which the cement content of the concrete is a minimum and the mixture contains more fine aggregate than is required for plasticity alone. Secondly, the sand content except for very fine sands can be increased several per cent above the minimum point without appreciable change in the cement content of the finished concrete.

Measurement of Aggregates

Investigation of measurement of aggregates indicated that any volumetric method of measuring aggregate, no matter how carefully made, is liable to error, measurement by weight appearing to be the only method whereby these errors can be eliminated. Since the specific gravity of an aggregate is practically constant, its weight varies directly as the volume of its solids and the errors of measurement are those due to balancing the scales in the aggregate.

Each of the experiences and investigations enumerated has influenced the practice of the Hydro-Electric Power Commission until today their methods are more properly a system for concreting than one of designing mixtures. Concrete is looked upon as a manufactured product, its production as a manufacturing operation and its control a systematic supervision of each step in the process of manufacture.

Present methods are described, including field testing, interpretation of field tests and field supervision and reports.

Before concluding the paper, the writer refers again to the design of mixtures and offers a warning based on his own experience in proportioning: Concrete mixtures should not be designed for strength alone unless strength is the only consideration.

Conclusions

It does not seem advisable in a paper of this nature to attempt to list in a set of conclusions each of the many points brought out. It will suffice to refer very briefly to what the writer believes are the principal lessons to be learned from the seven years experience of the Hydro-Electric Power Commission. These are:

1. The field control of concrete on the job is practicable and profitable.
2. The control of concrete on the job is applicable to work of all kinds and sizes.
3. The control of the quality of concrete is not a matter of designing mixtures nor of following some particular theory, but it involves every step in the production of concrete from the selection of the materials to the curing of the product.
4. While the water-cement-ratio-strength relation is subject to variations, with average well graded materials, no other means than this is necessary in designing concrete mixtures for a given compressive strength, but economy demands that cognizance be taken of the grading of the aggregates.
5. The concrete most economical in cement is not necessarily that having as much coarse aggregate as it is possible to use and still have its mixtures workable, but is usually one in which the sand is slightly in excess of this. The best combination of aggregates depends on the grading of both the fine and coarse aggregate.
6. Of the several processes in the manufacture of concrete, the measurement of aggregates and the placing of the mixtures are most important from the standpoint of quality.
7. Intelligent supervision of the materials and processes of concrete is essential to successful control of its quality.
8. The results of field tests of concrete should be interpreted with caution and in light of the conditions under which they are made, cured and tested, and for this reason comparison of field tests from different jobs is difficult.

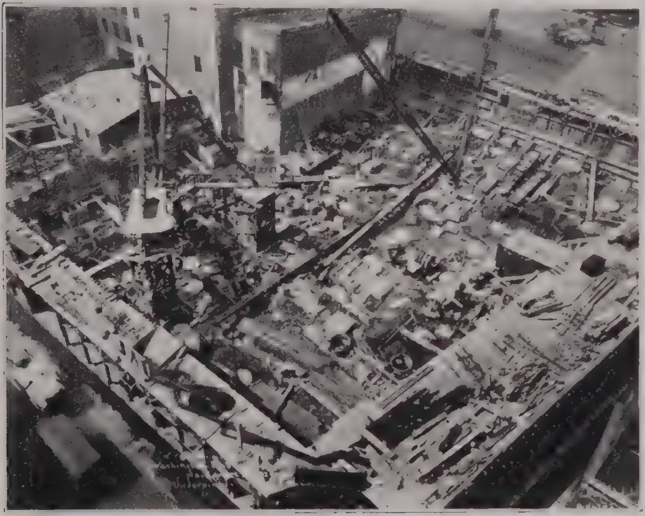
From a paper presented at the 22nd Annual Convention of the American Concrete Institute, Chicago, Ill., Feb. 23-26, 1926.

A Difficult Caisson Job

Putting in an 8000-Yard Concrete Substructure for a Newspaper Building—Foundations Carried More Than 50 Feet Below Street Level Through Sand, Water and Great Masses of Stone and Timber

By FRANK W. SKINNER
Consulting Engineer, New York City

The new 16-story steel frame home of the New York *Evening Post* is located on the margin of the East River, opposite the docks of the Lackawanna Railroad and the United Fruit Company, where the low, wet ground, reclaimed from the river, consists to a considerable depth of miscellaneous fill in which are buried many abandoned structures, such as old foundations, cribs, docks, piers and other masses of heavy timber and broken stone.



Caissons all sunk, completing pier concreting ready to commence steel erection. Floor concrete to be placed

Through this miscellaneous material and the sand and boulders underlying it, it was necessary to sink 86 separate foundation piers to satisfactory bearing in the hard stratum overlying bedrock. The piers penetrate from 1 to 10 feet in the hardpan, which has an approximately level surface about 50 feet below the curb. They are required to have a bearing satisfactory for loads of 10 tons per square foot, and as the quality of hardpan varies, so does the distance penetrated into it to secure this bearing strength. In some cases it was found necessary to go entirely through the hardpan down to rock about 60 feet below the surface.

Excavation to subgrade of the cellar floor, about 9 feet below the curb, was made with a Thew steam shovel, delivering to a fleet of 5-ton Mack motor trucks that entered and left the excavation pit by a ramp.

Below subgrade the foundation piers were carried down from 40 to 50 feet farther by the pneumatic caisson process that enabled satisfactory footings to be inspected and tested at any necessary depth.

As it was required to support the battery of heavy presses independently of the structural steel framework of its piers, a large number of separate foundation piers, some of them with small lateral dimensions, were required and were irregularly spaced in a number of longitudinal and transverse rows. In all there are 86 concrete piers, 45 of which have circular cross-sections from 5½ to 8 feet in diameter and the remainder are from 5 to 16 feet square or oblong. These piers, together with the cellar walls and the heavily reinforced cellar floors, 40 inches thick, required about 8000 yards of concrete, mostly 1:2:4 mix, made with 48,000 bags of Atlas Portland cement and chiefly mixed in a 1-yard Ransome machine. This mixer was set high enough above the general excavation to discharge into bottom dump buckets delivered over industrial tracks to the different caissons, into which they are dropped by four tower derricks with 50 and 60-foot booms operated by 2-drum Lidgerwood electric hoist. Motor trucks supplied as required pre-mixed ¾-inch aggregate delivered by the Colonial Sand and Stone Co. to a 125-yard bin. Small quantities of concrete were mixed in a 2-bag Boss machine mounted on wheels and operated by an 8 hp. 2 cylinder Le Roi gasoline engine.

Caissons Pre-assembled

Contrary to the usual practice in New York, the caissons themselves were all made of steel plate and angles and with one exception, which was too large for transportation clearances, were delivered at the lot whole and ready for use. The derricks set them bodily in position in trenches dug as deep as convenient to receive them, and the walls were extended upward in 7 and 8-foot lifts, forming permanent cofferdams that also served as forms for the pier shafts above the roof of the working chambers.

The cofferdams for the rectangular caissons were made

Contractor's plant installed, seven air locks in service, many caissons sinking or concreting, and cofferdam panels stored on sidewalk platforms of 2-inch dressed tongue and groove vertical planks bolted to transverse inside angles connected at their ends with bolted horizontal gusset plates that enabled the sections to be rapidly assembled and secured on vertical lines, while the horizontal joints were made with bolts through the flangers of the angles. The circular cofferdams were made of steel plates in 7-foot courses.

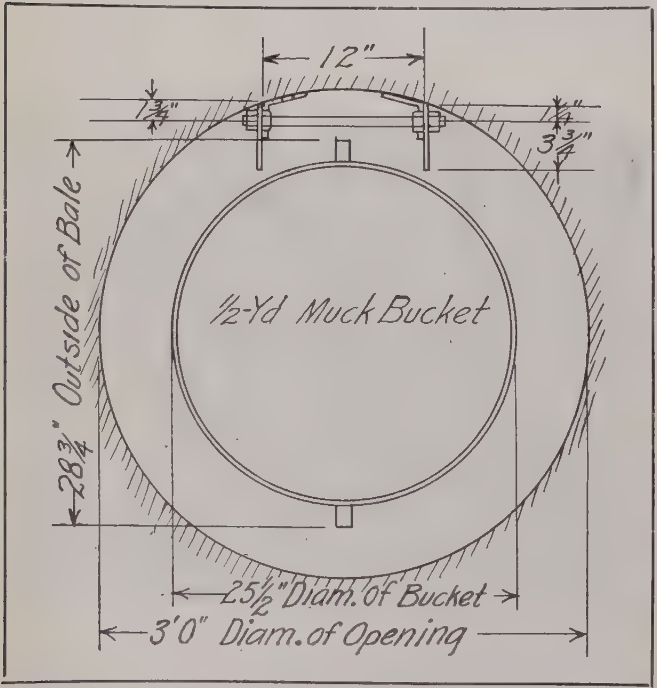
The cofferdams, which consisted of sectional extensions of the vertical walls of the working chambers of the pneumatic caissons, were all left permanently in the ground and served as forms for the concrete in the pier shafts, therefore all connection angles and braces were put on the inside and embedded in the concrete. The lower sections of the shaft tubes were permanently connected to the caisson roofs, but the upper sections were collapsible and were removed, as was the horizontal transverse angle-bracing that strengthened the sides of the cofferdams.

Coring Out

Part of the shaft tubes were cored out with collapsible wooden forms made integral with the form for the ladder chase, which served as a key and permitted the two semi-cylindrical sides of the form to be easily collapsed by revolution about their vertical full length joints diametrically opposite the ladder chase. Little difficulty was experienced in removing these forms if it was accomplished within four hours after concreting. The ladders used with the steel shafts were bolted on and were easily removed; those used with wooden cored shafts consisted merely of permanent steel rungs with their ends embedded in the concrete, thus necessitating the cutting of the core to remove the latter. The caissons, cofferdams and shafts were fabricated at the yards of the Federal Ship Building Co. and were delivered, completely riveted, by motor trucks.

The caissons were sunk in the usual manner with interior pick and shovel excavation, while the space between the 3-foot air shaft and the cofferdam walls was filled with concrete supported by the roof of the working chamber of the caisson.

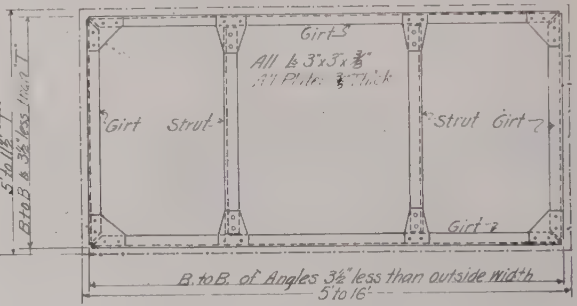
The caissons were undermined by the interior excavation and generally sunk so easily that but little ballast in addition to the concrete deposited in the cofferdams was required to overcome the skin friction. So many foundation piles and so much heavy timber and large riprap stone were encountered that the sinking was often very slow and much cutting was done with heavy chisels set in jack hammer drills and operated by air under 80 to 100 pounds pressure. The air was provided by a Chicago Pneumatic Tool Company's simplate valve compressor with a 600-foot capacity, operated by a 100 horsepower Westinghouse motor.



Enlarged Section Z-Z through shaft

Removing the Muck

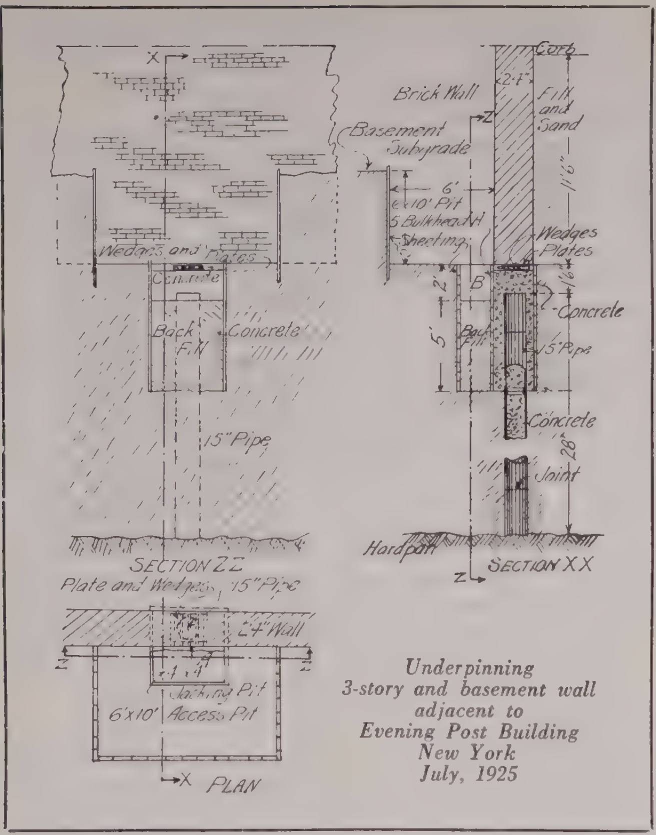
The muck and debris from the working chambers were hoisted through the air shafts in ½ and ¼-yard special cylindrical buckets and dumped into hoppers in the wide elevated working platforms that were built above the sidewalks protections on Washington and West streets. The contents of the hoppers were quickly discharged by gravity into the Mack trucks on the streets, which could be loaded and moved away in a few seconds without materially obstructing either street or sidewalk.



Horizontal section through cofferdam, showing bracing

After the completion of the caisson excavation, the working chambers were filled with concrete, carefully rammed in position especially under the roof of the caisson, where it was eventually sealed, and the concrete allowed to set under pressure for 24 hours or more. The air shafts and air locks were then removed and the shaft

Concrete mixer delivering to bucket on distributing track commanded by tower derricks



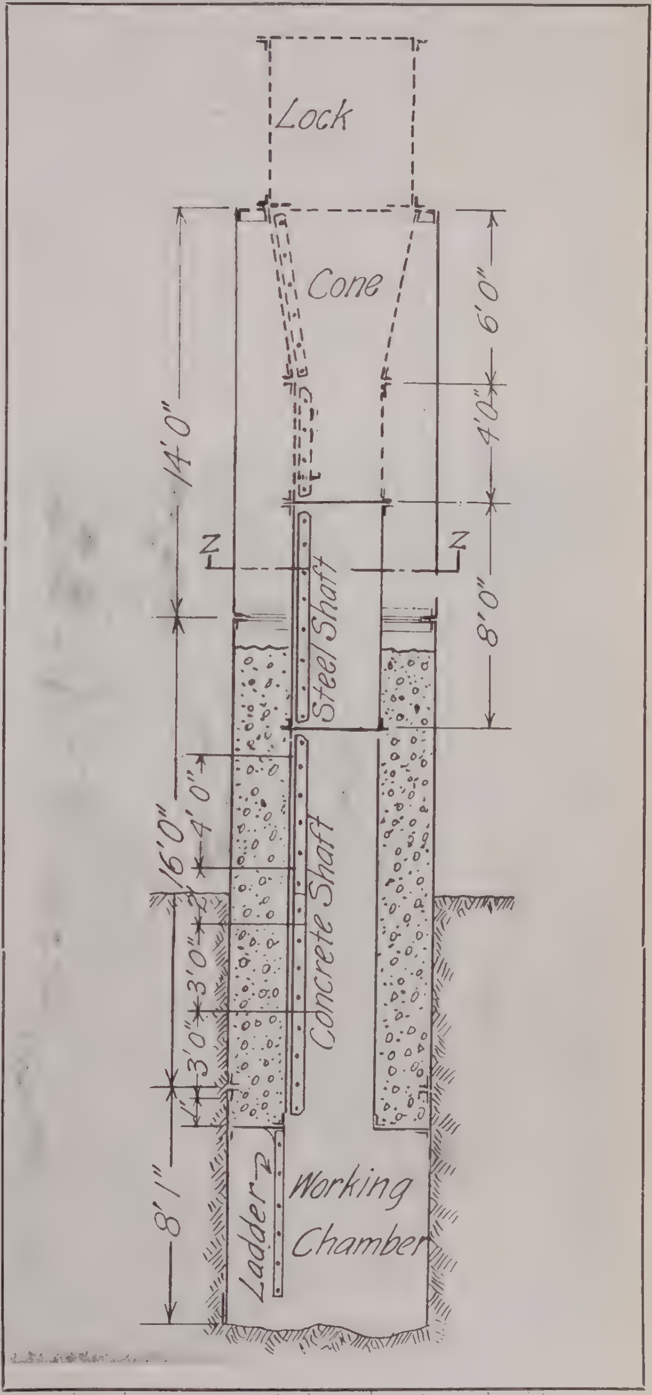
Underpinning
3-story and basement wall
adjacent to
Evening Post Building
New York
July, 1925

hole filled solid with concrete, completing the pier construction up to cellar floor level.

The concrete was placed by the sandhogs that sunk the pneumatic caissons and who received extra payment for each shift in which concreting was in progress. According

Delivering concrete by bottom dump buckets to hopper in top of material lock on shaft of pneumatic caisson

Collapsible wooden cores for air shafts



General arrangement of air chamber, shaft and lock to union rules, a separate foreman was required for each caisson, although in some cases there was room for only one workman in the working chamber. As the pressure did not exceed 17 pounds maximum, the work was done in full eight-hour shifts, employing about 100 men in the day shift and 50 men in each of the two night shifts.

Well Equipped Job

As the work was considered very urgent, the contractor made provision for executing it with very unusual rapidity. He installed a large equipment and employed as many men as could be profitably engaged; had the caissons and cofferdams delivered ready for immediate service and sunk as many as possible of them simultaneously, five generally being under air pressure at once, while others were in different stages of assembling, sinking and concreting.

The entire area of the lot was occupied by the caissons, derricks and concreting operations, while storage was afforded for cofferdam panels, light stores and materials, office room was provided and the working platform, 18 to 24 feet wide, which surrounded three sides of the lot over the sidewalks on Washington, Carlisle and West streets. Air compressors, locker rooms, rest rooms, hospital lock, smith and pipe shops and reinforcement storage were located and three K. G. oxyacetylene torches for cutting bars, pipe and miscellaneous steel work were installed on an adjacent empty lot that was fortunately available for the purpose. Very careful attention to details was given by the foreman, superintendent and resident engineer and every effort was made to foresee possible requirements and to provide material and equipment in advance, and to prevent any conflict of operations, so that no time was lost. All operations that could be simultaneously effected were handled so as to save every possible minute.

The dwarf orange peel bucket excavating interior of 15-inch underpinning pile

Underpinning a Wall

As several of the caissons are located within a few inches of the brick wall of a three-story and basement building on one side of the lot, there was a possibility that the caisson excavation might cause a disturbance of the fine sand under the shallow foundations. To prevent any danger of settlement, the wall was underpinned to a depth of 40 feet or more with concrete piles installed on its center line before caisson excavation alongside was commenced. On the face of the wall excavations were sheeted down to the bottom of the footing and there were commenced pits 4 feet square extending across under the full width of the footing and carried down about 7 feet below the footing. The sides of these pits were protected by horizontal curb boards and the water was pumped out as necessary to permit men to enter them and set short lengths of 15-inch steel pipe that were driven down into the sand by 100-ton Watson-Stillman hydraulic jack set against the underside of the old footing. As these pipes were driven their interiors were excavated by Hayward dwarf orange peel buckets, and if large stones or timbers were encountered they were broken with chisel bars or by dropping a heavy cylindrical weight upon them.

The little 30-pound buckets were operated by hand. Although their capacity was nominally only 100 cubic inches, they could be rapidly filled in soft material. For digging in hard strata they were loaded with a heavy hammer ball and when dropped to the bottom of the pipe penetrated even in hardpan and brought up good size portions. Their powerful grip and wide spread of jaws enabled them to lift the largest pieces of stone and timber that could be passed through the pipe. They were operated by a single man, and were very convenient and efficient.

As fast as the pipe sections were driven to the bottom of the pit, additional sections were coupled to the top of them by means of inside steel sleeves and the jacking was continued until the pipe reached hardpan or encountered a resistance of at least 80 tons, as indicated by the gage on the hydraulic pump. The interior of the pipe was then thoroughly cleaned and the pipe was filled with concrete. The upper part of the jacking pit was divided by a bulkhead parallel to the outer face of the wall and the space behind this bulkhead was filled solid with concrete enclosing the pipe and extending above it to within a few inches of the lower surface of the old footing. A pair of thick steel wedging plates separated by several pairs of thin folding steel wedges were then placed on top of the concrete and the wedges driven until the upper plate took bearing on the ground against the old footing. Other pits were successively opened at alternate position until eventually six steel-concrete piles had been installed ready to take the weight of the building and prevent any settlement should it be threatened by displacement of the sand. The wedges were left exposed for some time to permit adjustment, if necessary, while the caissons were being sunk and at last were sealed by grout or rammed mortar, and the access pits were backfilled up to the point where they received the concrete for the cellar floor.

The building is designed by Horace Trumbauer. The Thompson-Starrett Company are the general contractors. The work above described was executed by the Underpinning and Foundation Company, sub-contractor. Work was commenced April 1 and the last caisson was sealed August 10, thus accomplishing an unusually rapid execution of very difficult work that was retarded by the great number of hidden obstacles.

At the A. C. I. Convention

The Twenty-Second Annual Convention Proves That the American Concrete Institute Is Becoming of Growing and Enormous Importance to the World of Concrete Construction—Many Unusually Instructive Papers and Discussions Given Throughout the Week's Sessions

Tuesday noon, February 23, saw the opening of the twenty-second annual convention of the American Concrete Institute at the Sherman Hotel in Chicago. Possibly bigger and better and more instructive than ever before, the convention brought out new and startling ideas about concrete work and further confirmation on certain basic principles announced at previous meetings. Over 600 men were registered.

Space does not permit publication in full of every interesting paper and discussion presented to the assembled members, for that would require a sizable volume, instead of the few pages that are at our disposal. We will, however, as time goes on, present a few of these papers in brief form, and the first ones will be found elsewhere in this issue.

We must, because of space limitations, merely present to our readers a concise summary of the deliberations of the organizations.

The first session was opened by the president, A. E. Lindau, who reviewed the trend of the work done by the Institute during past years and up to the time of the convention. He successfully conveyed the impression that the Institute, in its twenty-two years of life, has done remarkable things and has possibly been the main contributor to the wealth of research and practical information, and has brought the art of concrete construction to where it is today.

The Design and Construction of Concrete Bridges

By A. BURTON COHEN

Many types of reinforced concrete and mass concrete bridges, box culverts and viaducts as used in railroad construction were described by Mr. Cohen, who is a consulting engineer in New York City. He reviewed the numerous considerations affecting the design of such structures, and showed, with the aid of the stereopticon, the various solutions that have been worked out by engineers in different parts of the country.

Requirements of limited overhead, of long span, of difficult topography and of other elements that restrict choice in the design of railway structures have caused many different types to be designed. Many of these were illustrated and explained by the speaker.

The Design of Rectangular Floor Slabs and Girders

By PROFESSOR HAROLD M. WESTERGAARD
University of Illinois

Professor Westergaard has investigated the theories used in the design of rectangular floor slabs and their supporting girders, and has worked out a new way of figuring stresses that should lead in time to a lighter system of construction. Professor Westergaard made use of the stereopticon in illustrating his points, and his theories and solution proved very interesting to the designers in the audience. Space does not permit even a summary of his ideas, as a short summary would prove valueless without the supporting data included in the paper. An interesting point brought out in the paper and in the subsequent discussion was that circumferential stresses are apparently set up in a slab as it deflects, and that a slab should be figured as a circular plate in order to provide sufficient steel to prevent the cracks that would normally occur as a result of the circumferential stresses.

Better Railway Track Support

By FRANK H. ALFRED
President, Pere Marquette Railway Company

The railroads will eventually run their trains on light steel rails supported by slabs of reinforced concrete—a concrete rail highway—according to the impression given by the interesting paper prepared by Mr. Alfred and read to the convention by Mr. Grandy of the same road. The point will soon be reached when a slab can be designed that will afford rigid support for the rails and afford a roadbed that will greatly reduce maintenance costs and permit other worthwhile savings in operating costs at the expense of more expensive initial construction. The Pere Marquette is about to construct an experimental section of this nature, and will try out various rail attachments, resilient cushions, rail weights, and so on in order to obtain the data that will be required whenever the new type of construction is really put into service. The suggested design calls for slabs 10 ft. wide, 39 ft. long and 18 in. thick. The rails, in one design, will rest on a truss system that will be part of the longitudinal reinforcement, and in another design they will rest on a pair of angles. A light weight rail will be used, since it will not be called upon to act as a beam as under the present practice, but will merely act as a wearing surface and will have to resist side thrust and other unavoidable stresses. The cost is estimated at $37,970 per mile on operating and maintenance, and the savings are estimated at $3,821 per mile per year, or about 10 per cent of the estimated cost.

Following the presentation of this paper the matter of the use of concrete by the railroads was made the subject for a symposium, wherein it was shown that the railroads have long pioneered in this field of construction. The proposition of concrete track base would come, it is said, as soon as the condition of the trackage warranted and as soon as economic conditions made it possible from the standpoint of financing construction.

Earthquakeproof Construction

By H. M. HADLEY
Portland Cement Association, Seattle

The evening session held on Tuesday was one of unusual interest. The leading feature of the evening was a paper by Mr. Hadley that gave the results of his observations upon the effect of earthquakes on construction and his suggestions for the construction of buildings that would not be damaged by earthquake shock. His investigations covered the recent shocks in Japan, the almost forgotten quake that destroyed San Francisco and the more recent disaster in Santa Barbara. In the main he showed how the shocks generally transmitted horizontal stresses in the buildings parallel to and vertical to the fault line involved, stresses quite similar to those occasioned to wind loads but which are more vibratory in action. Two types of structures are available to resist this action, either of which may be used. The structure should either be so resilient that it will react against the stresses without failure of any of the materials, or it should be perfectly strong and rigid but able to move freely in one direction as a unit without endangering stability or overstressing any of the materials. In either case the units of the structure should be well tied together, facing securely anchored to curtain walls, pilasters and spandrels, and the structure otherwise sound.

The geologists' side of the question was then ably presented by Arthur L. Day, director, Geophysical Laboratory, Washington. Dr. Day explained the present state of knowledge of the causes for earthquakes, the mapping of fault lines and the effect of and the nature of earthquake shocks. He presented the thought that filled ground and wet ground are dangerous sites for structures in an earthquake region because of the fact that the shocks are greatly amplified by the nature of such soil. This, he claimed, explained a great deal of the damage that has occurred on the west coast, even with the lighter shocks. The remedy would be to either avoid such ground or carry foundations down to a firmer base. He claimed that it is not difficult to predict the location of future shocks, but that the time of such shocks is yet impossible to foretell. In sections where such shocks are practically a certainty, he maintained, it is imperative that structures should be specially designed and constructed to resist damage. The means for doing this are now at hand. Building codes should be changed in order to require the better construction.

The Annual Question Box

Another high light of the evening's session was the annual question box—probably the backbone of the entire institute as far as immediate general application to the job is concerned—and five of the ten questions were answered at length by those whose experience had shown them a possible solution. The other five questions had to be held over until the next day because of the entire evening having been spent on the preceding papers and upon the discussion of the first five questions. The questions and a brief summary of the answers are given below.

Q. 1. Given a sudden cold snap in the course of concrete building construction, with a lapse in cold weather precautions, or a suspicion in the mind of the engineer in charge as to the possible inadequacy of covers or heating, what is to be the basis of subsequent judgment as to when forms shall be stripped?

A. A former president of the Institute stated that one freezing and one thawing would not hurt concrete appreciably, provided good curing conditions are subsequently afforded for a normal period before the forms are stripped, but that several alternate freezings and thawings would prove dangerous. Frozen concrete does not set or harden, so time frozen must be disregarded in calculating number of days that the forms must be left on. Several frozen jobs were saved by enclosing tightly and keeping heated to 100 deg. F. at the ceiling and no lower than 40 deg. F. at the floor level for ten to fifteen days before stripping the forms. Another tests with mallet and chisel and uses judgment in determining condition of the concrete. A prominent engineer concurred and said that the weather in the spring and fall in the north often brings the temperature down to the danger line. He suggested a jury of the most experienced superintendent and engineer available to examine the work, take a sample and heat it over a radiator, and otherwise test for hardening. If you can drive an eight penny nail into the concrete then stripping is not safe. Still another concurred, but suggested thawing the sample away from dry heat, and a still longer curing period. The first day is the most important for heating, he claimed. In cold climates two stories should be enclosed and heated.

Q. 2. What has experience taught in construction and in concrete products manufacture as to variations in hardening properties of standard portland cements at various temperatures and under special conditions of placing and curing? Are standard cements relatively uniform under ordinary conditions? Under unusual conditions?

A. One engineer answered by asking the question of whether we had any standard cements. He showed how variations in raw materials and in burning could easily account for slight variations in product, and that differences between plants could lead to brands with various properties. Another said that tests had indicated to him that a number of brands showed fair uniformity of fineness, time of set, and strength at normal temperatures, but that some marked variation of time of setting was discovered at low temperatures. Others suggested selection as to setting properties, and determining which cements were best for use in different sorts of conditions and on different kinds of work. A chemist then expressed a desire to know whether or not it was possible that the observed variations were due to test errors more than to the cement, and expressed himself as in favor of more standardized test procedure and methods.

Q. 3. By what methods can high early strengths be obtained with standard portland cements?

A. Dr. Abrams answered this question by saying that high early strengths could be obtained by mixing with less water, by increasing the time of mix, by admixtures of calcium chloride, and by otherwise following the essentials of good practice. Others concurred, but it was said that the admixture was hard on the steel.

Q. 4. Under what conditions is the use of retempered concrete permissible or of advantage?

A. Dr. Abrams claimed that holding for three hours from mixer to forms gave increased strength, provided that the concrete is placed while it is still plastic. He said that the best way to patch a concrete floor is to prepare a stiff mix and let it stand for a while before using. The excess water is absorbed by the aggregate and the cement, and thus shrinkage cracks in the patch are avoided.

Q. 5. How can you apply the principles of quality control to the small job?

A. Mr. McMillan presented his solution in the form of a convenient leaflet showing the water-strength curve and directions for mixing for strength. A very handy and simple method. Mr. Watson presented a slightly more involved and exact method, equally simple, to enable the foreman to apply the same principles and obtain the same results on the small job. Mr. Young testified as having used the first method with the greatest convenience and success. It can be used and understood by any good foreman.

The Wilson Dam—How It Was Built

By **MAJ. M. C. TYLER**

Engineer Corps, U. S. Army

The district engineer of the great Wilson dam, part of the Muscle Shoals development, read a very interesting paper Wednesday morning on the construction of that project, described the construction plant, the mixing units, the construction of the forms, handling the forms and other features of the work. He was followed by John W. Hall, resident engineer for the Hugh L. Cooper Co., engineers, who read a paper on the control of the quality of the concrete on that job—a paper that was prepared by J. C. Evans of the same concern. He told about keeping up the strength of 1,300,000 cu. yds. of concrete, and the field control methods used, the methods used in making the job watertight, and otherwise described the working of the job in a complete manner. An interesting revelation was made when he showed temperature records taken by thermometers buried at different depths in the mass concrete. He demonstrated that high temperatures could be attained at times in the interior of the mass, and that expansion may be taking place on the interior while contraction would be occurring on the exterior, giving rise to stresses that are not usually considered.

Seven Years' Experience with Job Control

By R. B. YOUNG

Hydro-Electric Power Commission, Toronto, Canada

Mr. Young, who has had quite a lot of experience with quality control, told of the work being done by his organization and how the field control is effected. They first worked out a method of proportioning based on surface area and the water-cement ratio in order to get workability and strength. They carried on laboratory investigation to check field findings and apparently found the water-cement ratio essentially true but not strictly accurate. They abandoned the use of the surface area idea in 1921. In conclusion he stated that field control is profitable, that field control does not concern itself with design but follows design, and that the water-cement ratio is all that is needed provided that well graded aggregates are used. He also stated that grading and oversanding is true economy and that the results of field tests should be interpreted with caution. Discussion revealed that test cylinder generally underestimated the strength of the concrete actually going into the forms, that samples should be cured under like conditions to afford correct results and that the water-cement ratio affords the simplest method of quality control.

Quality Control on Pittsburgh Stadium

By W. S. HINDMAN

Consulting Engineer, Columbus, Ohio

The inundation method was used on this work to insure the correct amount of sand in the batch, while the slump test gave a measure of the consistency, although it proved to be rather erratic in results. In general the designed strengths were exceeded, and the refinement of the concreting plant was found to be justified. The strength of the batches was unusually uniform, according to the test cylinders broken.

The Question Box Concluded

The concluding questions in this feature of the program were taken up in the Wednesday afternoon session, having been put over from the previous meeting. Question 6 was not answered, since no one was present to discuss the matter, and since a good solution was presented in a previous paper.

Question 7, relating to the placing of concrete in heavily reinforced deep beams, was answered by a contractor who said that the work could best be done by using a dense but plastic mix, by first depositing a layer of mortar at the bottom and then filling up, working from one end, with more concrete, pushing the first layer along and up against the bars. Wooden paddles are needed to carefully puddle each batch. Each batch to be dumped as near as possible to its final position.

Question 8 was eliminated as of no great immediate interest to those present.

The plastering of concrete surfaces, covered by Question 9, brought out two opposite opinions. One was that plastering with a well tempered plaster could be easily and well done if the plasterer is skilled and the surface clean and free from the smoke and soot from the salamanders. The other opinion was that metal lath, tied to the ceiling, is needed to afford mechanical bond for the plaster.

Cracked concrete will heal of its own accord, under certain conditions, according to the answers to Question 10. Experiences along these lines were reported by Messrs. Earley, Abrams, and Hollister. Greater strengths than before failure were reported for the healed sections. Success with architectural concrete and with a concrete arch bridge were reported. Moisture and time are apparently the main requirements, the moisture acting upon the soluble materials and forming "scar tissue" crystals of great strength.

New Experiences in Field Control

By JOHN G. AHLERS

Barney-Ahlers Construction Corp., New York City

Mr. Ahlers told about further experiences with job control, on recent jobs where its feasibility has been proven beyond doubt. Now using water-cement ratio entirely, and have developed a device for balancing cement against water just prior to charging. Grading is a secondary and after problem. He has perfected a routine that gives no trouble. Make up water-cement ratio curves as a guide on the work, solving for different strengths. He says that the manufacture of concrete is a contractor's problem and that the job is his laboratory. Working from a strength specification entirely has its advantages. On one job of 14,000 yds. the control cost was $2,700 and the saving in material was $4,800, or a net saving of about $2,100.

He was followed by F. R. McMillan, who described in detail what the same method of control means, and described how it worked out on the recent construction of the Portland Cement Association Building, in Chicago, where a strength specification was used. He presented a convenient specification of this type as a part of his paper, and cited data from the laboratory tests of the concrete mixed on that job and the savings of cement that were made possible. More will be said of this paper in a later issue.

Following that paper, Committee E-5 presented a Purchasing Specification for Aggregates, three amendments were made, and it was adopted as a Tentative Standard for one year, subject to letter ballot. The last year's report of Committee C-5 on the Measurement of and Estimating Concrete, made tentative standard last year, will be proposed as Standard to the members by means of a letter ballot.

Architectural Session

An outstanding feature of the entire convention was the architectural session of Wednesday evening. The first speaker after the presentation of the report of the committee on Destructive Agents was John J. Earley, whose work has frequently been described in CONCRETE. He made an effective presentation of his ideas on concrete design, making the decorative shell of architectural concrete and treating it as a separate unit and not as part of the utilitarian structure. He showed views of his recent work in the south on the Parthenon and at the University of Louisiana. Then he presented a new idea. Put water into the mix in sufficient quantity for workability, he suggested, and then remove it again when placing is accomplished, leaving only enough for the maximum strength. His method of doing this is with the use of porous forms that will automatically take the excess water out of the concrete.

The next paper was prepared by David C. Allison, architect, and read for him by Col. Boyden. This paper dealt with the work of that architect on the west coast and showed the unusual architectural effects possible with concrete as an exterior finish.

Then followed a short talk by W. A. Maloan, whose name has been mentioned in connection with modern stucco work in a recent issue of this journal. Mr. Maloan hit the older method of applying stucco and then told about his ideas on the subject and how it is possible to obtain a really permanent and attractive stucco at a reasonable cost. He then donned his overalls and proceeded to demonstrate the application of the scratch coat and several very attractive finish coats in one, two, and three colors, and in a variety of textures.

Effect of Lime on Products

By PAUL C. CUNNICK
Director of Laboratories, Rock Island Arsenal

The Thursday morning session opened with a report of some tests recently made at the Rock Island Arsenal, with the cooperation of the National Lime Association, to determine the effect of lime on concrete products. This paper is extracted elsewhere in this issue. Following it, discussion brought out the opinions that these tests could not be considered conclusive since the differences in values were so small and since no tests beyond six months were yet available. Improvement in strength, appearance, and absorption was reported. The increased strengths were based upon averages but individual samples frequently departed from the apparent trend. Some members discussing the tests were not satisfied with the amount of data available on cements or aggregate used.

The rest of the session was devoted to the discussion of committee reports on concrete stave standards, methods of testing concrete masonry units, crazing, the future work of Committee P-S, on cast stone and architectural concrete, and a progress report from Committee P-6 on the methods of curing concrete building units.

Following this session a complimentary luncheon was tendered by the Blaw-Knox Company, where several speakers described the concrete work being carried on as part of the Wacker Drive project. Then followed a film prepared by the same manufacturer explaining the inundation principle and their device for measuring sand by this method. Then a number of inspection parties were formed and taken over the Wacker Drive job where the inundator was observed in use, and where a field testing laboratory was to be seen. This work has already been described in an earlier issue.

New Officers Named

The installation of officers opened the Thursday evening ssession when the names of the men who have been chosen to direct the course of the Institute for the ensuing term were announced. Maxwell M. Upson, New York City, was elected president, John J. Early, Washington, D. C., was elected vice-president for the two-year term and the following directors were named: First district, A. C. Tozzer, Boston; Second District, John G. Ahlers, New York City; Sixth District, Rudolph J. Wig, Los Angeles. Harvey Whipple, Detroit, was re-elected secretary and treasurer.

In commenting on the past growth of the Institute which at the date of the close of the convention had over 1900 members, President Lindau likened the members to the aggregate cemented together by the common interest in the uses and improvement of concrete.

The Wason Medal

The Wason medal was awarded to E. A. Dockstader for the most meritorious paper at the 1925 convention. A new field of research was entered by Mr. Dockstader, and some important work was done in the way of tests made to determine the temperature in reinforced concrete chimney shells. These tests were the basis of the paper winning the award.

Awarding the Penwiper

In widening the scope of the Institute by increasing the membership, the secretary had during the past year referred to the "hand embroidered penwiper" to be awarded to the member who secured the largest number of new members prior to the convention. The honor was won by Prof. Duff A. Abrams, with 37 new members to his credit. The penwiper, which bore the emblem of the A. C. I. was supplemented by a desk pen set. F. R. McMillan received second honors, and as a reward for having increased the membership by 23 he was awarded a pen and pencil set.

Architectural Floors—Especially Terrazzo

Much information of interest to architects was distributed throughout various papers on the program particularly those prepared by architects, but these facts were confined largely to the exterior finish. Architectural floors and methods of finishing them were discussed in a paper by H. S. Wright, Structural Bureau, Portland Cement Association. Special attention was paid to the proper laying of terrazzo, and further information on this subject will be included in an abstract of the paper in a later issue.

Concrete Culvert Standards

A design as well as a load test specification has been included in the tentative specifications for concrete culverts. B. S. Pease, chairman of Committee J-2, offered the tentative specification as part of a progress report and recommended that the committee be continued in its representation on the Joint Culvert Pipe Committee. The three classes of pipe previously specified have been reduced to two, standard reinforced concrete pipe and extra strength pipe.

Reinforced Concrete Chimneys

Two reports dealt with concrete chimneys, the first being the report of C. E. Nichols, outlining the work of the Committee S-I, and the other a paper by Benjamin Wilk describing tests that are being made on a reinforced concrete chimney at the Universal Portland Cement Company's plant at Duluth. This latter report is summarized elsewhere in this issue.

Extensibility of Concrete

Professor W. K. Hatt outlined a preprinted paper on the extensibility of concrete, distinguishing between the various cracks that occur in concrete structures, including crazing, water cracks, fissure cracks, or cracks visible to the eye. Investigations have indicated that microscopic cracks are not detrimental to the structure and if eye-visible cracks can be postponed by proper reinforcing, the life of the structure will be increased. Investigations are being continued on expansion and contraction and the fatigue of reinforced concrete. Interesting results by German investigators were shown and the conclusion drawn that there are many factors yet to be determined.

Seven and Twenty-Eight Day Strengths

The relation of 7 and 28-day compressive strengths of mortar and concrete was covered in a paper prepared by Willis A. Slater, U. S. Bureau of Standards, and summarized by Stanton Walker. An abstract of this paper will be presented in a later issue.

In discussing the relation of the 7 and 28-day compressive strengths of mortar and concrete, the fact was emphasized that the variation of different brands of cement must be taken into consideration with particular reference to the early stages of the test specimens.

The Most Significant Tests of Concrete

Different kinds of concrete structures are called upon to withstand varying conditions and stresses. A. T. Goldbeck in a paper on the most significant tests for concrete, stated the test should bear a direct relation to the resistance the concrete must have. Among the factors mentioned as requiring attention are weather conditions and alkali resistance. Properties required of concrete include tension compression, cross bending, and in some cases there is a direct relation between tests of different properties.

Compression is a most important test and may be used as an indication of other properties of the concrete. Cross bending strengths cannot be determined by compressive stress alone.

The shear of concrete is of minor importance and the shearing test not easy to make. Impact is an involved subject and import tests should be made under practical conditions as met in the actual structure.

Surface abrasion tests are important only when concrete is subject to abrasion action. The common laboratory tests for abrasion cannot readily be made to compare with actual wear.

Low absorption and high strengths are important in concretes to resist chemical action due to alkali, acids, etc. Resistance to freezing and thawing depends upon the strength of the concrete, the amount of absorption, fine material under 100 mesh present in the concrete, and the amount of water present.

Proper design takes care of shrinkage, and expansion due to moisture. A relation between permeability and compresive strength is apparent when the concrete is properly cured.

Fire resistance of concrete depends upon the character of fine and coarse aggregates, and the richness of the mix. High quality concrete shows a definite resistance to fatigue indicating some relation between strength and fatigue.

Research

A brief synopsis of the report of the committee on research was read by H. F. Gonnerman. A voluminous report was prepared by the committee dealing with research at various research laboratories and educational institutions. A questionnaire was sent out inquiring as to research recently completed or under way and subjects on which research is needed. A great number of important researches are indicated by the results of the questionnaire.

A compilation is being made of researches in the United States and also in foreign countries.

Iowa Concrete Products Association Convention

The 1926 convention of the Iowa Concrete Products Association, held on February 18 and 19 at the Hotel Blackhawk, Davenport, Iowa, was in every way the most successful convention which has ever been held by the association. The attendance was considerably larger than at any previous meeting, and the interest manifested by everyone present was maintained throughout the entire program.

Possibly the talk which attracted the most attention was that given by R. F. Havlik, on the subject of Architectural Stone made from Concrete. Mr. Havlik is a recognized authority on this subject, and was able to illustrate his remarks with examples gleaned from experience in his own plant at Aurora, Illinois. A number of Iowa manufacturers are interested in the production of this material, and Mr. Havlik's talk was particularly appropriate in view of that fact.

Another talk that attracted a good deal of attention was given on the question of freight rates in their application to the Concrete Products Business by George Cummins, Traffic Commissioner of the Davenport Chamber of Commerce. There was also an interesting discussion of various methods of manufacturing the ordinary concrete products, lead by Mr. Ben Wilk.

Herman E. Meier, of Davenport, was elected president for the coming year, and Floyd Goodrich, of Waterloo, vice-president. Ross Dowell, of Des Moines, continues as before in the office of secretary and treasurer. Next year's convention will be held at Cedar Rapids, Iowa.

The Reinforcement Investigation Report Proves Value of Mesh

By **B. S. PEASE**
American Steel & Wire Co., Chicago, Ill.

The impartial investigation made during this year by the Highway Research Board of the National Research Council at Washington on the economic value of reinforcement in concrete roads was the outstanding item of interest to all those who are in any way connected with roadway and pavement design and construction. This investigation which covered a total of over 2,000 miles of pavement and a service survey of some 370 miles, shows so conclusively the advantages to be gained by the use of suitable fabric reinforcement in concrete pavements, and in concrete bases under other pavements, that it does not now seem possible for any differences of opinion in this important feature of pavement and roadway design. Wire Fabric Reinforcement, according to this report, reduces the rate of cracking and prevents opening up of such cracks as do form, thereby increasing the life of the pavement. Smaller and more closely spaced steel members give better results than larger members spaced farther apart. A light Wire Fabric weighing 25 pounds per 100 square feet gave remarkable results, which were greatly in excess of what would theoretically be expected for such a small amount of steel. By increasing the weight of fabric to 56 pounds per 100 square feet, the rate of cracking was still further reduced.

This investigation also brought out the economic value of Wire Fabric Reinforcement in concrete bases under brick and asphalt pavements. This is a feature that has only recently received proper consideration.

Everyone interested in pavement and roadway construction should secure copies of the summary of this full report and those who wish to go more deeply into the vast amount of authentic data collected by the Highway Research Board should secure copies of the entire report.

Italian Cement Company to Use Old Arsenal

A company has been formed at Pola, Italy, with a 10,000,000 lire capital which will use the old Austrian arsenal as a factory for the manufacture of portland cement. The company is pledged to produce 6,200,000 centrals annually in consideration of government concessions to it.

Don't let that city engineer tell you that a concrete pavement is "not as good." Make him design for probable traffic, show him your good jobs, and then let him call for prices. There are still a lot of farmers buying roads, and they don't seem to know that the horse and buggy age has given way to the Concrete Age.

Cement Sets at Freezing Point

Drexel Institute Tests Are Said to Show That Setting Takes Place at 32° Fahrenheit, but That the Action Is Slow — An Admixture Reduces the Setting Time Considerably

By
LEWIS R. FERGUSON
Consulting Engineer, Philadelphia

MILES N. CLAIR
Formerly in Charge Strength of Materials Dept., Drexel Institute;
Now in Charge of Tests, Thompson & Lichtner, Boston

Tests recently completed by the writers at the Drexel Institute, Philadelphia, show that while cement sets very slowly at 32° F. it nevertheless sets very definitely and without actual freezing of the mixture. The following summary of these tests gives interesting evidence of the effect of temperature on the initial and final setting times of various brands of cement, and of the effect of the use of a standard accelerator in overcoming the retarding action of low temperatures.

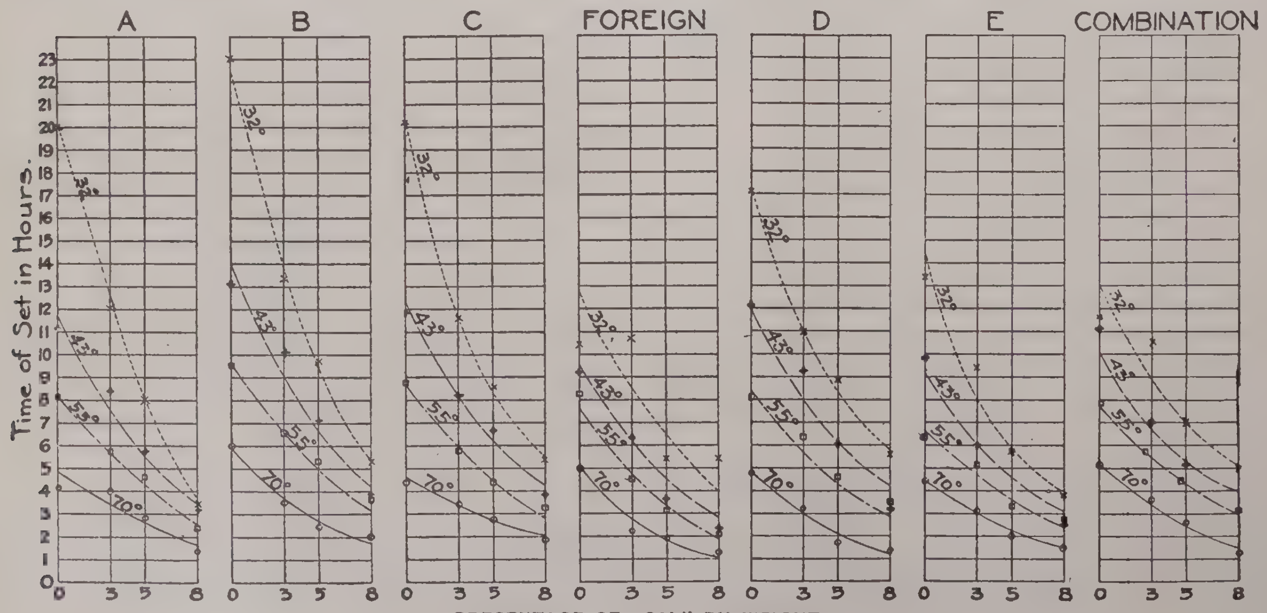
Six individual brands of cement and a blend of these six were used and setting times determined for four temperatures, 70° F., 55° F., 43° F. and 32° F. The accelerator used was Cal (oxychloride of calcium) and both cement and accelerator were purchased from a building supply dealer in Philadelphia. The regularity of final set results made it permissible to plot curves (See chart) but the initial sets were erratic, and therefore the points are joined by straight lines. The latter are not shown here.

1. The results indicate very clearly that Portland cement will attain a final set even at temperatures of 32° F., although this set is very much retarded by the low temperature.
2. An examination of the final set results shows that a change in temperature from 70° F. to 32° F. multiplies the final setting time by between three and four for all brands except the foreign cement and the blend.
3. The addition of 8% of the accelerator causes the time of set at 32° F. to be the same as at 70° F. without the admixture.
4. The addition of 5% accelerator causes the setting time at 32° F. to be the same as at 55° F. without the admixture.
5. The proportionate effect of Cal increases as the temperature decreases.
6. The addition of the admixture greatly increases the workability of the cement.

Test Methods

The time of set was determined by means of the Vicat apparatus. Rings were molded at 70° F. in the laboratory and were placed at once in a container packed in ice. The temperature in the container was checked by a thermometer and regulated to approximate the storage temperature. Within about 15 minutes the container and specimens were removed to the particular storage room. The specimens were removed from the container in the storage room and constantly watched until initial and final sets had been obtained. The time of addition of water to the cement and of the gaining of the initial and final sets were recorded. The temperature in the storage room remained absolutely constant during the period of set as checked by Maximum and Minimum thermometers. Some doubt arose as to whether or not the specimens at 32° F. were frozen and therefore all of these were removed to

EFFECT OF TEMPERATURE ON THE TIME OF FINAL SET OF CEMENTS WITH AND WITHOUT "CAL"



70° F. after final set had apparently occurred. In no case was there indication of freezing.

TABLE NO. I

The Water Required for Normal Consistency

Cement	Percent of Oxychloride of Calcium			
	0	3	5	8
A	24.4	25.3	26.3	27.0
B	22.6	23.6	25.0	26.0
C	23.6	24.0	25.0	25.6
D	24.4	24.0	25.4	27.0
E	22.6	24.2	25.6	27.2
Foreign	22.4	23.8	25.0	26.2
Combination of all	22.2	23.4	25.0	26.6

Consistency

The normal consistency results (table 1) indicate that the addition of the accelerator to neat cement requires an increase of water over that which would be required for the addition of the same amount of cement. This agrees with Bulletin No. 13 of the Structural Materials Research Laboratory, but disagrees with Technologic Paper No. 174 of the Bureau of Standards. There was a very decided difference noticeable in the working of cement with or without Cal. The addition of the latter caused the cement to become fat or slippery, with the appearance of increased fluidity. This increased fluidity is not the same as the property called consistency and measured by the Vicat needle, it is rather an increased workability due to the lubricating effect of the admixture.

New Concrete Sewer Pipe Plant in Texas

The Bent Concrete Pipe Co. has just gone into production in Fort Worth, Texas. According to H. B. Tellyer, district manager, only 6 to 15-inch concrete sewer pipe are being made at this time, and less than one-third of the capacity of the plant is being utilized. An average of 500 lineal feet per day of concrete pipe is now being made. As soon as crews have been broken in and the plant put into capacity operation, the production is expected to reach 1,500 lineal feet of pipe daily.

This concern expects to increase the capacity of the plant next year, and a full stock of all sizes of concrete pipe will be carried, running from 4-inch to culvert size. These products will be sold direct to municipalities in the Fort Worth district.

Products Manufacturers Are Testing Their Block

The Weekly Letter, January 12, of the secretary of the Wisconsin Products Association, reads as follows:

"To the Wausau Concrete Company, Wausau, Wisconsin, goes the 'concrete hat' for being the first one to have made a test during 1926.

"One of the big reasons why the Wausau Concrete Co. were able to make this test and pass it with flying colors when weather conditions were much against them was because of steam curing. They steam cure their blocks 48 hours.

"Just as soon as all of us realize that concrete products manufacture is not a summer's job, but an all-year proposition, just so soon will we get on an equal basis with other building materials.

"The manufacture of concrete building units is no longer a backyard pastime. It has become a big carefully managed proposition."

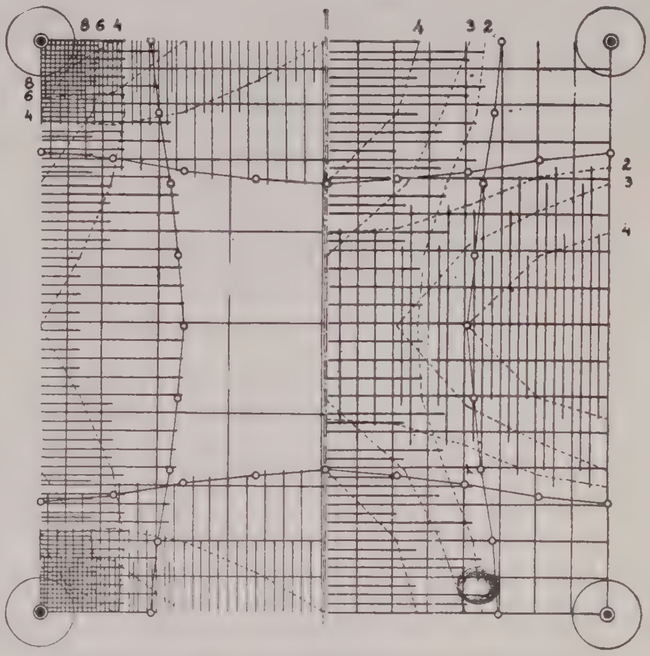
Here is an idea for the consideration of the manufacturer who has not yet modernized his plant.

The First Concrete Mushroom Floor in Greece

Abstracted from *Zement* by E. Lee Heidenreich.

The accompanying illustrations show the first concrete floor of the mushroom type built in Greece. Fig. 1 illustrates the upper and lower reinforcing as placed in the floor. The floor slab is 18 ft. square with an 8 ft. cantilever. The negative and positive moments are indicated by lines interrupted by the small circles. The entire construction shows an economical comprehension of the principles of the mushroom construction.

Fig. 2 shows a view of the finished floor.



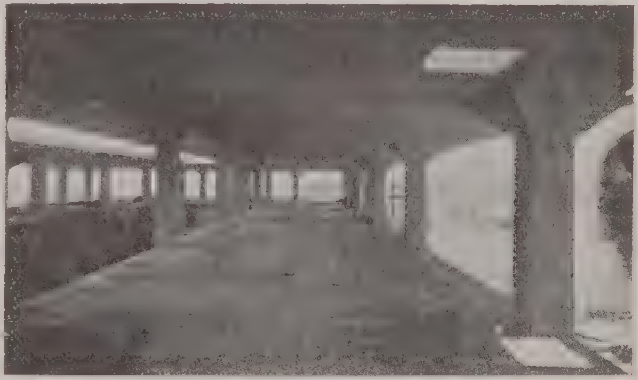


Fig. 2. The finished floor of the Greek building

Highway Congress Created in Chile

The government has promulgated a decree creating an institution of a permanent character called the "Congreso de Carreteras" or Highway Congress, the purpose of which will be to better the roads of Chile and to keep in touch with modern improvements, the American Embassy at Santiago informs the Department of Commerce. This measure was adopted on the recommendation of the First National Roads Conference (Primer Congreso Nacional de Vialidad) recently held in Santiago. The Governing Board created by the decree will include various heads of governmental departments as well as private individuals.

Repairing a School Foundation

Difficult Job of Underpinning Gives Faulty Construction Solid Footing and Overcomes Danger of Collapse of Brick Structure

It is not the big, outstanding job that gives the real trouble in the contracting game; rather it is the little concealed "pocket job" so to speak, hard to get at, laborious to complete, but which on the surface shows little accomplishment after the last finishing touch has been added. That's the sort of thing that puts gray in the concrete man's hair.

An example of this type of work is found in a small job finished recently at San Antonio, Texas, by Coleman & Jenkins, general building contractors and concrete specialists. In detail it was essential to the saving of a costly school building, so much so, in fact, that in turning the work over to the contractors, the Board of Public Education called for no bids or contract. "There it is; it's a mean job we are handing you. Do your best and make your bill as reasonable as possible," was, in its essence, the only agreement between the board and the concrete men.

Under certain portions of San Antonio, a peculiar, white adobe clay, which underlies the surface at a distance of a few feet, has proved the bane of contractors. When dry, this clay appears to offer splendid bearing properties for concrete foundations. But, when this clay gets wet, there is no counting upon what it will do. In one recent experiment conducted by Willard E. Simpson, structural engineer of San Antonio, a pressure of 25,000 pounds to the square foot was applied to a block of this clay, which then was wet through thoroughly. The result was as though yeast had been mixed with the clay, which swelled to such an extent that it lifted its load a half inch—a truly wonderful performance. But, on the other hand, the same sort of clay might have shrunk under pressure, contractors say, for it is changeable in its mood.

At the school house in question, the foundation had been laid in this clay by the original contractor, and, an additional error in judgment was made when the rain spout, leading from the gutter on the roof was located directly over one corner of the foundation. As a result, water pouring from the roof during heavy rains had caused the thorough wetting of the clay, which at this point, instead of expanding, had contracted, allowing the corner of the building to drop approximately two inches out of line with the rest of the building, a two-story concrete, brick and stone structure. The walls, both outer and inner, had cracked, great cracks had appeared in the plastering on the interior, and the stone facing at intervals on that corner also had cracked. The result was an undesirable job which any contractor might well be loath to face.

The problem presenting itself to the contractors was to hold the corner of the building—raise it if possible—in the meantime "gophering" underground to find a firm foundation clay, and then to support the building in such manner that there would be no further danger of earth expansion or contraction affecting the stability of the superstructure. The lives of many children might depend upon the solidity of the contractor's work and the job, therefore, was one on which no chances could be taken. The building was so unsafe as to be unuseable for school purposes in its condition at that time.

Previous effort had been made by contractors to correct the situation. Excavation had been made under the corner, timber braces used to support it during the operation and a solid block of concrete, 4x6x6 feet, had been

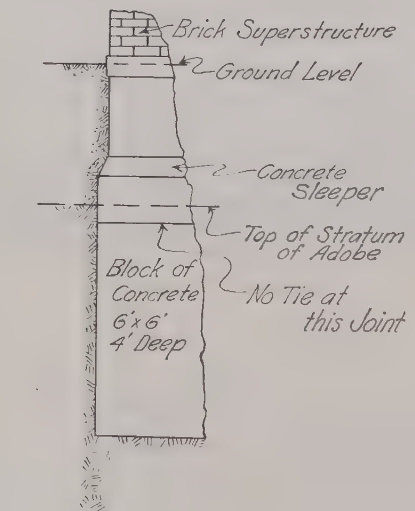


Fig. 1—Sketch showing condition of foundation before the underpinning job was undertaken, sketch not drawn to scale.

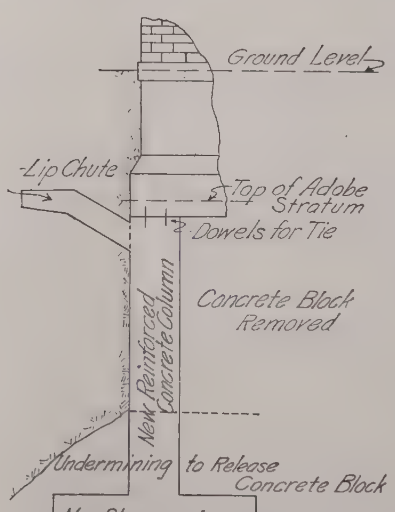


Fig. 2—Sketch illustrating the arrangement after the new concrete foundation was poured and method of placing concrete.

poured, without a footing of any sort. The effect of this work had been merely to increase the pressure due to the weight upon the soil and enhance, rather than retard, its recession. As the block was not tied to the upper foundation in any manner, it followed the clay as it receded and aggravated the situation.

The problem faced by Coleman & Jenkins therefore was not only to shove up the corner and install a firm foundation, but to remove the concrete block and get rid of useless excess weight upon the sub-soil.

In accomplishing this task, the first step was to sink an open shaft alongside the corner of the building, where at depth of seven feet the footing course of the original foundation was passed and the solid concrete block reached. The excavation, enlarged at the bottom, was continued until a total depth of 20 feet from the surface had been reached. In the meantime, the corner of the building had been chiselled out and another lip made three feet back, and four 8x8-in. timbers, 20 ft. long, were set in place at each angle to hold the corner suspended during the course of underground work. A mean feature of the job was that but three men could be employed, owing to restricted space.

After the big concrete block was undermined, it was allowed gradually to slip forward, being chipped away until it had been entirely removed.

A lip-chute was then installed and a concrete sleeper, 7 by 7 in. by 16 ft., reinforced with half inch steel, was poured. From this a column 14 by 14 in. was poured into wooden forms, which gradually were raised until the old sleeper was reached. Into this sleeper four dowell holes had been previously drilled four inches deep, and four pieces of one-half inch reinforcing steel inserted, running the full length of the column and spaced four inches each way.

The column form was filled to within two inches of the old footing, then allowed to set overnight, in order to get rid of the natural contraction of the material, and the following day a rich 1 to 1 sand and cement grout was poured to act as the final binder between old and new construction. Hydrostatic pressure kept the column full and made a neat bond.

After the concrete had hardened for a few days the underpinning of timbers was removed and the building was found to be firmly held in place. In the opinion of the contractors and structural engineers who viewed the job, the under-stratum of clay upon which the new footing rests, will offer none of the treacherous qualities of the old white clay stratum.

Concrete House at Chicago Home Show

Three full size facades, showing various materials and products in the applied form, will be features of the Sixth Annual Chicago "Own Your Home" Exposition to be held in the Coliseum, March 27 to April 3 under the auspices of the Chicago Real Estate Board.

These exhibits have been planned to get across to the Exposition visitors the thought that homes are attractive and *desirable.* A real home, not merely four walls of even the most superior materials. Coloring, landscaping, garden walks, awnings, all combine with the materials used in construction, to make a charming picture. The most successful exhibits use "background."

An elaborate front elevation will be erected on the Coliseum floor by the Hydro-Stone Corporation and the Hawthorne Roofing Tile Company in the form of a Spanish bungalow with an elaborate garden arrangement. The walls will be constructed of Hydro-Stone wall units and manufactured stone architectural treatment. Various types of roofing tile in many colors, and samples of ornamental manufactured stone, fireplaces and garden furniture, will also be featured in this exhibit.

A new metal frame screen will be exhibited by the Burrowes Weatherstrip Company, working models of the action of weatherstripping will be displayed by the Victor Weatherstrip Company, and the Sager Metal Weatherstrip Company. The Sager company will show a cabinet constructed to demonstrate the weatherstrip under extreme air pressure by pumping air into the chamber. A beautiful structure has been planned by the David Lupton's Sons Co., showing copper steel residence windows, casements and basement windows of various types, attractive finishes and methods of draping and screening, with various types of hardware and details of construction.

The Detroit Steel Products Company will build a section of a house in the old English style, showing a bay window, fitted with their "Fenestra" casement windows. The wall of this facade will be of imitation rough stone and the woodwork used will have a rough hewn finish, carrying out the old English idea.

Investigations on Cement-Lime Mortars of Interest

An increase in workability and possible reduction in cost are the principal reasons why lime might be used to advantage in cement mortars, judging by results secured in recent tests at the Bureau of Standards. When lime plaster is gaged with cement, it still retains considerable of its former workability, and has gained in strength, while the time of set is reduced, according to a recent report.

In this work the Bureau found that when cement paste and lime paste were brought to the same consistency, a much greater percentage of water was required by the lime than by the cement. With this relation holding, the percentages of mixing water in cement mortars and in lime mortars increased with a decrease in the percentage of sand. A cement mortar with lime added requires extra mixing water, but this extra water increases shrinkage possibilities, therefore lime should be limited in cement mortars where it is desired to keep shrinkage low. It is possible to keep shrinkage low by the use of a high percentage of sand in any mortar.

The density of lean cement mortars may be increased by the addition of a small percentage of lime. Where the cement mortar is not richer than 1:2, the addition of lime may result in increasing the strength. The percentages of lime which may result effectively in these respects were found to increase with the leanness of the mortar. It is probable that the lime does more than set as a void filler in lean cement mortars, for it can carbonate and form a binder in the place of the missing cement.

It is not to be expected that these results will be duplicated exactly where other brands of materials or differently graded sands are used with different manipulation and under different storage conditions.

The following are among the more important construction projects reported recently by Assistant Trade Commissioner W. J. Donnelly, Ottawa: Hydro power development for Coaticook, costing $180,000; pumping station at Montreal.

Some contractors are good plasterers. It's better to let them get the jobs than to bid against them. They will be back at their trade a whole lot quicker that way.

Dam Foundation Grouted Under Pressure

Interesting Cost Figures on Gerber Dam Contract in Oregon—Foundation Rock Drilled and Grouted Under Pressure as Concrete Was Poured—Plum Rocks Provide Bond at Joints Between Pourings

Unusual features in the Gerber Dam built for the Klamath irrigation project, Oregon, and interesting construction methods employed in building a variable radius arch type structure are summed up by A. L. Darr, resident engineer, in the *New Reclamation Era.* The dam was begun early in March, 1924, and was completed June 1, 1925. It was constructed by contract, the contractor being W. D. Miller of Klamath Falls.

Purpose of Reservoir

The reservoir is located about 46 miles east of Klamath Falls, in the heart of the old cattle country of southern Oregon. It receives its impounded water from Miller Creek, one of the two main tributaries of Lost River. The area that will be submerged at spillway elevation is about 3,800 acres, with a storage capacity of 94,000 acre-feet.

The purpose of the reservoir is two-fold—to provide storage water for lands of Langell Valley lying adjacent to the lower portion of the Creek and to provide means of control of the flood waters of Miller Creek so they will be prevented from overflowing the bed of Tule Lake. These latter lands have been reclaimed by the unwatering of Tule Lake, which is the outlet for Lost River. The unwatering was made possible by the construction of a storage dam at Clear Lake, and by the construction of a diversion channel through which the average discharge of Lost River can be diverted into Klamath River. With the completion of Gerber Dam the principal portion of the flow of Lost River is under control, and it is not probable that its flood waters in the future will reach the basin of Tule Lake in sufficient quantity to cause material damage.

The dam is situated on Miller Creek at the upper end of a canyon, and is about 10 miles above the point where the creek enters Lost River. The walls of the canyon are generally steep and formed of seamy volcanic rock and bowlders. The submerged area is largely meadowlands, and includes a large portion of the old Louis Gerber cattle ranch as well as several smaller holdings. The drainage area contributing to the storage basin covers about 200 square miles, with an average precipitation of approximately 13 inches annually. One-half of the watershed is fairly well covered with timber, the remainder being devoid of any growth except sage brush and scattering junipers.

Design of the Dam

The dam is of the variable radius arch type, and is 150 feet in length at channel elevation, and 478 feet long at the top. The spillway crest is 60 feet above the stream bed and is 150 feet in length. The top of the 3½-foot parapet wall is 10 feet above the spillway crest. The capacity of the spillway with a 7-foot depth is 10,000 second-feet.

Excavation for foundations was carried about 18 feet below the stream bed. The portion of the dam constructed in forms is 15 ft. thick at stream bed elevation. The foundation trench across the stream bed averages about 24 ft. in width and is filled with concrete. Five feet below the spillway crest the thickness of the dam is 5 ft., which dimension is carried to the base of the parapet wall, 14 in. in width.

Outlet works were installed near one end of the spillway, with trash rack above and operating house below. Conduit pipes are three in number, 36 in. in diameter and 21 ft. in length. Cast-iron high-pressure gates, 30 by 30 in. are installed at the downstream end of the conduits. which are hand operated by geared hoists. Air inlet and water bypass pipes are installed near each gate.

Character of Foundation

The character of the dam foundation was carefully investigated before construction. Open test pits were used,

The Gerber dam, Klamath project, Oregon, completed, and the impounded reservoir and leakage tests were made with water under pressure, to test the water tightness of the foundation rock. Both the leakage tests and the open pits showed satisfactory lava rock for the foundation and abutments of the dam. The rock as then disclosed was not entirely homogeneous, but roughly stratified in layers of hard and soft lava. The lava was broken and seamy but the seams were generally tight and where crevices existed they were compactly filled with stiff clay.

Actual excavation confirmed the conclusions of the preliminary examination in general. However, the layers of hard lava disclosed by the test pits in many cases were found to be made up of loosely conglomerated bowlders, often separated by clay-filled seams which disintegrated upon exposure. The soft layers were generally water-tight, but also disintegrated with exposure and yielded quite readily to a pick.

On account of the showing of the open cut it was considered necessary to carry the foundation well into the rock. As an additional precaution against the tendency of the water to cut a channel around the end of the dam in the soft layers, a keyway 2 to 3 ft. in depth and of about the same width was cut into each soft layer. This was filled with concrete as the dam was poured. To further prevent the erosion of the soft material under-velocities due to reservoir heads, and to transfer a part of the thrust resulting from arch action to the walls of the excavation. forms were omitted and concrete poured against the walls wherever solid rock was encountered.

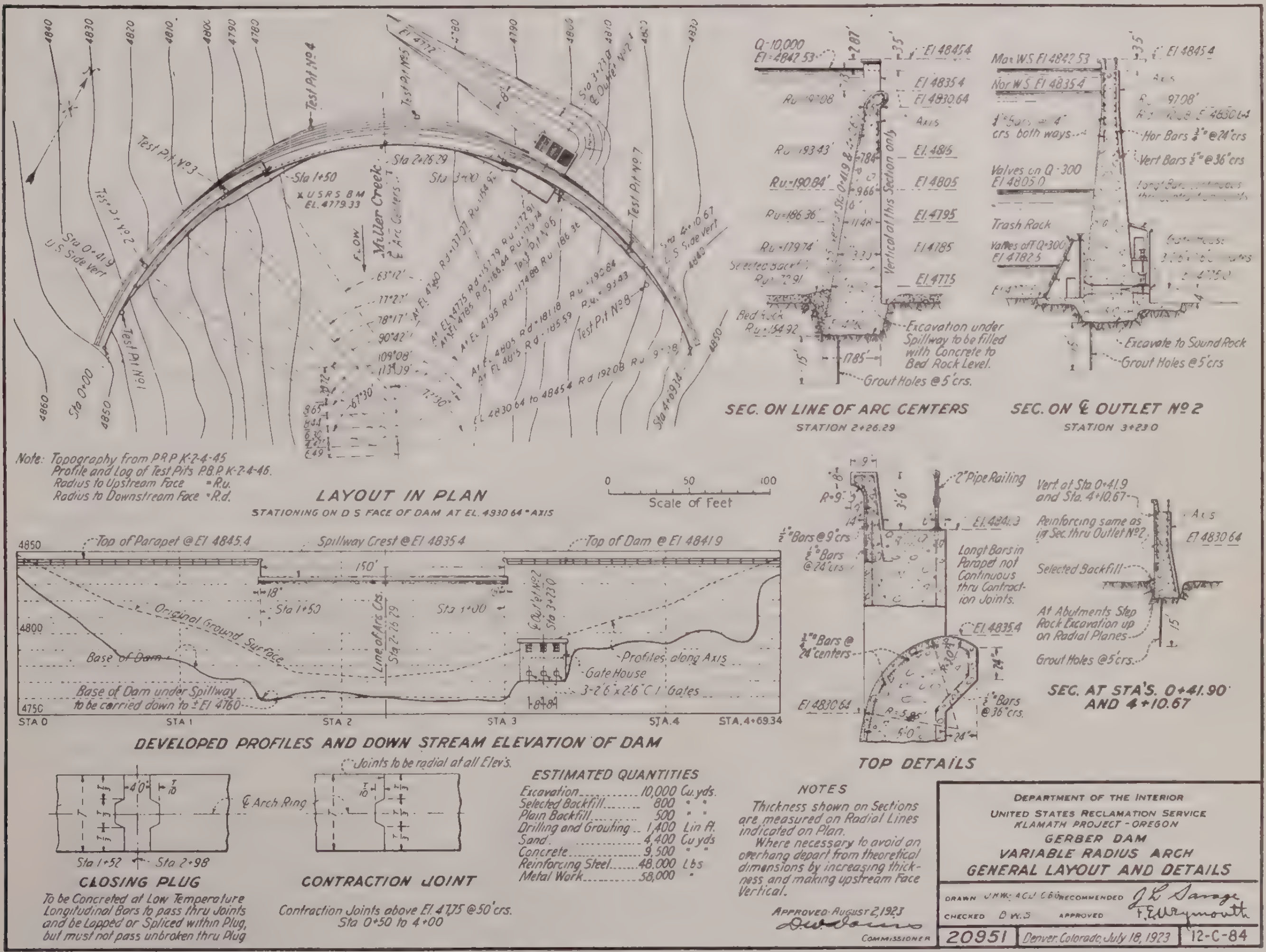
Although the rock, as before stated, was considered water-tight and proved so by test, the foundation was grouted as an additional precaution. Grout holes were drilled 5 ft. apart throughout the length of the dam 2 in. in diameter and 15 ft. in depth. Pipe 3 in. in diameter and 8 ft. long were set in these holes, and after concrete had been poured to a depth of about 6 ft. in the dam the holes were grouted under 100 pounds steam pressure. Other grout holes were drilled wherever a seam occurred in the foundation. In some cases three parallel rows of holes were used where the foundation seemed especially open; 200 sacks of cement were used to fill the 112 grout holes drilled. As many as 17 sacks were used in a single hole, 4 holes in one section of the foundation requiring 42 sacks. The amount used ordinarily was 1 to 1½ sacks to the hole. Where the foundation appeared noticeably poor, extreme precaution was taken in the way of omitting forms and filling the excavation section with concrete, for the purpose of securing arch action over the weak spots, and securing a better bond with the side walls of the cut.

Pouring the Concrete

The total amount of concrete placed in the dam was 11,888 cu. yds., utilizing 15,900 barrels of cement. About 125 barrels were used in grouting and for bond between pourings. The quantity of cement per cu. yd. of concrete ranged from 1.28 to 1.50 barrels, according to the mix. The total amount of reinforcing steel required was 62,933 pounds, and metal work totaled 78,067 pounds.

Plum rocks were placed in the concrete where forms were not used and to provide a bond in joints between pourings.

Pouring was begun August 12, 1924, and by December 16, when pouring was discontinued on account of cold


LAYOUT IN PLAN
STATIONING ON D S FACE OF DAM AT EL. 4930 64 = AXIS
Note: Topography from P.R.P. K-2-4-45
Profile and Log of Test Pits P.B.P. K-2-4-46.
Radius to Upstream Face = Ru.
Radius to Downstream Face = Rd.
Scale of Feet
Miller Creek
FLOW
Test Pit No 1
Test Pit No 3
Test Pit No 4
Test Pit No 7
Test Pit No 8
Sta 1+50
Sta 2+26.29
Sta 0+00
Sta 4+69.34
SEC. ON LINE OF ARC CENTERS
STATION 2+26.29
Excavation under Spillway to be filled with Concrete to Bed Rock Level.
Grout Holes @ 5' crs.
SEC. ON ℄ OUTLET No 2
STATION 3+23.0
Trash Rack
Excavate to Sound Rock
Grout Holes @ 5' crs.
Top of Parapet @ El 4845.4
Spillway Crest @ El 4835.4
Top of Dam @ El 4841.9
Original Ground Surface
Base of Dam
Base of Dam under Spillway to be carried down to ± El 4760
Line of Arc Crs. Sta 2+26.29
℄ Outlet No 2 Sta 3+23.0
Profiles along Axis
Gate House
3-2'6" x 2'6" C I Gates
STA 0
STA 1
STA 2
STA 3
STA 4
STA 4+69.34
DEVELOPED PROFILES AND DOWN STREAM ELEVATION OF DAM
Joints to be radial at all Elev's.
℄ Arch Ring
Sta 1+52
Sta 2+98
CLOSING PLUG
To be Concreted at Low Temperature
Longitudinal Bars to pass thru Joints and be Lapped or Spliced within Plug, but must not pass unbroken thru Plug
CONTRACTION JOINT
Contraction Joints above El 4775 @ 50' crs.
Sta 0+50 to 4+00
TOP DETAILS
2" Pipe Railing
Longt Bars in Parapet not Continuous thru Contraction Joints.
SEC. AT STA'S. 0+41.90 AND 4+10.67
Reinforcing same as in Sec. thru Outlet No 2.
Selected Backfill
At Abutments Step Rock Excavation up on Radial Planes
Grout Holes @ 5' crs.
ESTIMATED QUANTITIES
Excavation 10,000 Cu. yds.
Selected Backfill 800 " "
Plain Backfill 500 " "
Drilling and Grouting 1,400 Lin Ft.
Sand 4,400 Cu yds
Concrete 9,500 " "
Reinforcing Steel 48,000 Lbs
Metal Work 58,000 "
NOTES
Thickness shown on Sections are measured on Radial Lines indicated on Plan.
Where necessary to avoid an overhang depart from theoretical dimensions by increasing thickness and making upstream Face Vertical.
Approved August 2, 1923
D. W. Davis
Commissioner
Department of the Interior
United States Reclamation Service
Klamath Project - Oregon
GERBER DAM
VARIABLE RADIUS ARCH
GENERAL LAYOUT AND DETAILS
Drawn J.H.W. - A.C.L. - C.B.W.
Recommended J L Savage
Checked D. W. S.
Approved F. E. Weymouth
20951
Denver, Colorado, July 18, 1923
12-C-84

General layout of Gerber variable radius arch dam, and diagrams giving section details and details of joints.

Cost of Gerber Dam and Reservoir

Excavation, 15,952 yards, at $3	$ 47,856.00	
Placing concrete, 11,888 cubic yards, at $11.50	136.712.00	
Selected backfill, 1,571 cubic yards, at $1.25	1,963.75	
Grouting foundation, 1.680 linear feet, at $3	5,040.00	
Placing steel reinforcement, 62,933 pounds, at $0.06	3,775.98	
Placing metal work, 78,067 pounds, at $0.05	3,903.35	
Manufacturing sand, 1,971 cubic yards, at $6.55	12,906.20	
Hauling sand, 3,832 cubic yards, at $5.67	21,745.37	
Extra work	1,366.44	
Materials furnished by contractor	349.42	
Total contract earnings		$235,618.51
MATERIALS SUPPLIED BY UNITED STATES		
Cement, 16,068 barrels	$ 48,896.80	
Marysville sand. 603 cubic yards	1,614.80	
Metal work and reinforcement	3,480.53	
Outlet gates and conduit, 54,182 pounds	10,107.61	
Pipe for grouting, 1,080 linear feet	662.17	
		64,761.91
MISCELLANEOUS EXPENDITURES BY UNITED STATES		
Purchase of reservoir site, 1,800 acres	$ 27,032.30	
Royalty	500.00	
Surveys, test pits, plans, estimates	11,691.58	
Telephone line	2,698.50	
Relocating and building 7 miles of county road	7,773.60	
Drilled well 300 feet deep	2,759.62	
Estimated cost, cottage, barn, and outbuildings for gate-keeper	6,000.00	
Camp maintenance	1,136.02	
Engineering and inspection	10.071.06	
Superintendence and accounts	3,540.20	
General expense	12,423.27	
		85,626.15
Total cost of storage works and reservoir site		386,006.57

weather, 11,846 cu. yds. had been placed. The remaining 24 cu. yds. were placed in May, 1925. The amounts poured each month were as follows:

	Cu. Yds.		Cu. Yds.
August, 1924	1,900	November, 1924	1,589
September, 1924	4,730	December, 1924	283
October, 1924	3,362	May, 1925	24

Weather conditions were generally favorable for contract work, special measures for protection being required during cold weather of December. Materials were heated and concrete kept warm in the forms, so that no concrete in place was damaged by frost.

Forms used consisted of 4 by 8-ft. wooden panels faced with 20-gauge sheet iron. Two sets were used, the lower being lifted above and set on the plate of the upper as the work progressed. Pouring was thus conducted in 4-ft. lifts. The forms were anchored by No. 8 gauge wires, doubled, to rows of wire anchors made of No. 6 gauge wire and 18 in. long. About 10,000 lbs. of wire was thus used and left in the dam. Spreaders 2 by 12 in. were used on top of the 4-ft. forms, cut to exact width at the level on which they appeared. These spreaders served as a guarantee that the forms would remain in place and that the required thickness of the dam would be secured. They served to reduce both the engineering and form work required, and acted as joists for flooring when such was needed in the work. Channels 10 in. wide and 6 in. deep were left in each pouring joint to prevent leakage.

Hard clean igneous rock was secured adjacent to the dam site in sufficient quantities to furnish the required supply for concrete. Sand used consisted of various blends of local sand from three pits, basalt sand manufactured at the crusher plant, and sand shipped from Marysville, Calif. The haul from pit No. 1 was about 4 miles; that from pits 2 and 3 averaged about 17 miles. The length of truck haul for Marysville sand from the railroad siding to the dam site was about 27 miles. Various mixes were used, according to the blend, ranging from 1:2:4 to a 1:2¼:4½ mix. About 55% of the sand used was local sand, 11% Marysville, and 34% manufactured basalt sand.

Slump tests were taken at regular intervals during the progress of the work. It was the intention to produce concrete of a consistency corresponding to a slump of 3 in. in the main body of the dam, a slump of from 6 to 8 in. being permitted in thin reinforced walls.

Cement and sand briquettes and cylinders of concrete taken from the forms were also made regularly, to check the tensile strength of the cement and for compression observations.

Contraction joints were maintained at intervals of 50 ft. with two closing segments 4 ft. in width which were poured at low temperatures.

Experimental Apparatus

Apparatus was installed for the purpose of enabling a series of observations leading to the underlying laws of the distribution of stresses in the dam. These stresses result from temperature changes, deformation from various causes, and deflection due to load. Seventeen thermometers were placed at three levels in the dam, at the center, distributed from face to face of the structure. These thermometers are electrically connected with a switch board in the gate house. Nine deformation stations were placed on the down stream face of the dam and two on top. Those on the face provide 8 measuring stands, and those on the top, one each. Measurements will be taken at various water levels in the reservoir, and seasonal. For measuring deflection, four targets were set at different levels on the down stream face of the dam on the line of arc centers. Land targets were placed at one end of the dam, and a sliding transit base at the other. Lines of sight observed from a transit on the sliding base, through the targets on the dam, to the land targets, and compared for various reservoir levels, will provide means for determining presence of movement of the dam.

Plant Equipment

The crushing plant, storage bins, and mixing plant were located on the hillside above and near one end of the dam. The capacity of the crushing plant operating 16 hours was about 140 yds. of rock, 25 yds. of which was made into basalt sand. About 7,000 cu. yds. was poured by gravity by means of chutes and pipes. The remainder was carried by chute to a hopper in the stream bed and re-elevated by steam hoist to a high line. The concrete was carried on the high line in a bucket supported by a traveller. The bucket dumped directly into forms or chutes.

Three and one-half per cent of the sand listed was used in grout for priming new pourings and as waste in rejected and spilled concrete around the bins and plant.

About 17,000 acre-feet of the spring run off was stored. The maximum water surface behind the dam reached an elevation of about 35 ft. above the level of the creek bed and about 25 ft. below the spillway crest. At first there was a little leakage through the concrete in a few places, all of which practically ceased in a few weeks. There was no visible leakage under the dam or around the ends. No springs developed in the canyon below the dam, and the reservoir bottom appears to be tight, the data thus far obtained indicating that substantially all losses can be accounted for by evaporation.

Due to expansion of its business and present inadequate facilities, the Pennsylvania Crusher Company has removed its offices to the Liberty Trust Building, Broad and Arch Streets, Philadelphia. The increasing demands made upon this firm have from time to time necessitated additional space, until the former location in the Stephen Girard Building has finally been outgrown.

Effect of Lime on Concrete Products

By PAUL C. CUNNICK
Director of Laboratories, Rock Island Arsenal, Rock Island, Ill.

In order to determine the effect of lime on concrete products, investigations were carried on at the Rock Island Arsenal during 1925, involving some 1,500 test operations. As a result, it was discovered that the strength of concrete block made by the dry-tamp process is increased on an average of 1 per cent for each added pound of hydrated lime per sack of cement until the admixture reaches 40 per cent. Aged lime putty gives considerable increase in strength, also much quicker set than equivalent amounts of hydrate. All percentages of lime tested show increase in strength from 28 days to six months age.

Determined by the standard immersion test, absorption increased uniformly from 6.2 per cent without lime to 7.5 per cent with the maximum lime content used. As determined by the impounding of water on one face, absorption is not increased by the use of lime. Permeability, as determined by the latter test, is eliminated by the use of 20 per cent or more of hydrated lime or the equivalent in lime putty. Penetration of dampness into the product decreases as the lime is increased.

Two block plant tests were made, and these were supplemented by tests of samples prepared in the laboratory. The units manufactured by the tests were made during the regular run of production at the plants of the Northwest Davenport Cement Block Works, Davenport, Iowa, and the Builders' Materials Co., Cedar Rapids, Iowa, with the exception that special mixes were used according to the plan of the investigations, and that a batch measuring box was added to the equipment of the latter plant for more accurate proportioning. This latter equipment is still in use at that plant. The usual operating procedure of neither plant was interfered with other than just noted, although care was exercised to insure uniform tamping of the units. The consistency of each block was kept near the maximum wetness that could be handled efficiently by the machine. It is believed that typical plant conditions were involved in the manufacture of these samples. Table 1 shows the results gained with the block from the first plant, while Table 2 shows the effect of lime on the 28-day compressive strength of the units manufactured at both plants and at the laboratory. Table 3 shows the effect of lime on absorption, permeability and dampness penetration. The same relationships are shown in the curves, which were taken from these and other tabulations derived from the tests. Compressive strengths for ages greater than six months are not available, but the general progression of strengths at the earlier ages indicates no likelihood of retrogression. Samples will be tested at various ages up to two years, in order to determine the long-time effect of the lime admixtures. Extra samples are on hand to permit five-year tests if found advisable.

Any final discussion of the economics of lime admixtures in concrete products is probably premature at this point in the investigation. The outstanding facts are that lime increases the strength of a product and improves other desirable properties. Increased strength can be utilized by obtaining a greater number of units per sack of cement when lime is used. These cement-lime units have certain advantages of appearance and water tightness that make for greater marketability. Further plant tests will be necessary in order to determine the relation of the cost of the lime to the value of the advantages arising from its use. However, several concrete products plants have started using lime as this investigation has been developing.

Mix.	Cubic Feet Natural Materials.		Cubic Feet Dry and Rodded Materials.		Fineness Modulus of Mix.	Total Water Content, Pounds.	Blocks Per Sack of Cement.
	Sand.	Gravel.	Sand.	Gravel.			
1:4	2 00	3 00	1 74	3 00	4 20	49	11 0
1:5	2.25	3 50	2 83	3 50	3.90	56	13.8
1:6	3 50	4 25	3 04	4 25	4.00	63	16.6
1:7	4 00	5 00	3.48	5.00	4.02	70	19.4
1:8	4.67	5.67	4 06	5.67	4.15	78	22.2
1:9	5.17	6 33	4 50	6.33	4 01	85	25 0

7-Day Compressive Strengths.
Pounds per sq. in. of gross area.

Mix.	No Lime.	5%—5 lb. Hydrate.	10%—10 lb. Hydrate.	15%—15 lb. Hydrate	20%—20 lb. Hydrate.	10%—22½ lb. Quicklime Putty.
1:4	1232	1258	1490	1330	1450	1750
1:5	863	752	1040	1063	980	1110
1:6	615	480	555	659	752	885
1:7	430	632	553	581	728	664
1:8	409	450	449	530	436	640
1:9	314	343	439	427	456	..

28-Day Compressive Strengths.

Mix.	No Lime.	5%—5 lb. Hydrate.	10%—10 lb. Hydrate.	15%—15 lb. Hydrate	20%—20 lb. Hydrate.	10%—22½ lb. Quicklime Putty.
1:4	1473	1655	1805	1551	1430	2120
1:5	996	1034	1180	1245	1066	1245
1:6	943	775	945	1040	1204	1109
1:7	585	816	707	856	957	1007
1:8	575	853	622	774	710	837
1:9	426	440	515	610	570	....

Note.—All strengths are the average of three crushing tests.

Table 1. Proportioning data and test results, block plant test No. 1

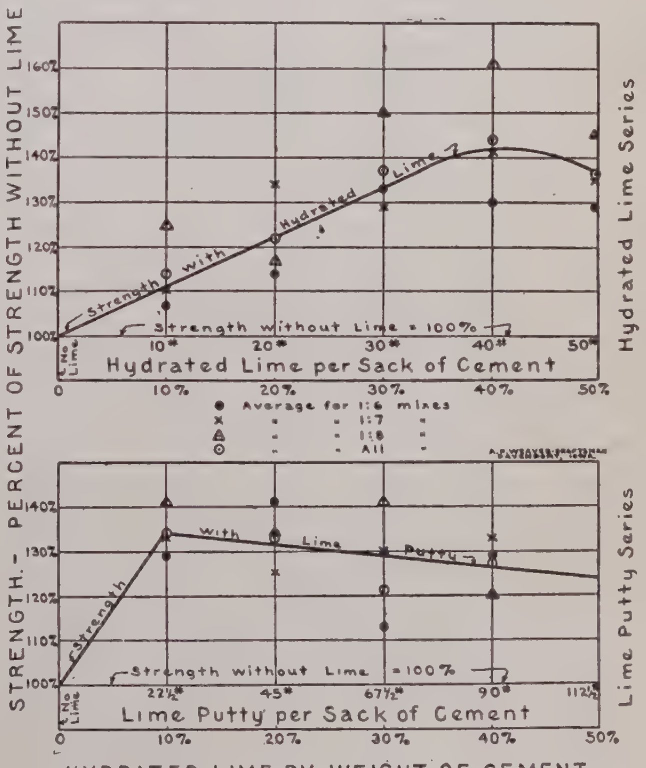


Fig. 1. Effect of lime on 28-day compressive strength

Abstracted by permission from a paper presented at the Twenty-second Annual Convention of the American Concrete Institute, Chicago, February 23-26, 1926.

	Marked.	Proportion of Cement to Aggregate.	Lime added per Sack of Cement, pounds.	Plant Test Number 1.		Plant Test Number 2.		Laboratory Experiment.				Average Strength as Compared With Same Mix Containing No. Lime, per cent.
								Steam Cured		Water Cured.		
				Gross Strength, pounds.	Per cent of Strength Without Lime.	Gross Strength, pounds.	Per cent of Strength Without Lime.	Net Strength. pounds.	Per cent of Strength Without Lime.	Net Strength, pounds.	Per cent of Strength Without Lime.	
Hydrated Lime Series	60	1:6	None	943	100	1130	100	1315	100	1190	100	100
	61†	1:6	10†	945	100	1235	109	1540	117	1280	108	107
	62†	1:6	20†	1204	128	1180	104	1950	148	1610	135	114
	63†	1:6	30†	....	...	1211	107	1980	150	2010	170	133
	64†	1:6	40†	....	...	1005	89	3520	270*	2800	235*	130
	65†	1:6	50†	....	...	888	79	2305	175	2160	183	129
	70	1:7	None	585	100	1016	100	1050	100	840	100	100
	71†	1:7	10†	707	123	1061	104	343	33*	239	29*	110
	72†	1:7	20†	957	162	1248	123	1080	103	1100	131	134
	73†	1:7	30†	....	...	1128	111	1520	145	1260	150	128
	74†	1:7	40†	....	...	1379	136	1425	135	1310	156	141
	75†	1:7	50†	....	...	1270	125	1365	130	1330	158	135
	80	1:8	None	575	100	663	100	705	100	715	100	100
	81†	1:8	10†	622	110	852	128	890	139	980	137	125
	82†	1:8	20†	710	121	724	109	780	111	930	130	117
	83†	1:8	30†	....	...	925	139	1157	164	1130	158	150
	84†	1:8	40†	....	...	958	144	1165	166	1365	101	161
	85†	1:8	50†	....	...	888	134	1125	157	1125	157	145
Quicklime Putty Series	60	1:6	None	943	100	1130	100	1315	100	1190	100	100
	61‡	1:6	22½‡	1109	118	1125	99	2225	171	2020	170	129
	62‡	1:6	45‡	....	..	1198	107	2015	154	2310	195	141
	63‡	1:6	67½‡	....	..	887	78	1770	135	1955	164	113
	64‡	1:6	90‡	....	..	1216	108	1710	130	2130	179	129
	65‡	1:6	112½‡	....	...	940	83	....	...	....	...	?
	70	1:7	None	585	100	1016	100	1050	100	840	100	100
	71‡	1:7	22½‡	1007	172	985	97	1380	131	1735	207	135
	72‡	1:7	45‡	....	..	943	96	1105	105	1690	201	125
	73‡	1:7	67½‡	....	...	733	74	1790	170	1705	202	130
	74‡	1:7	90‡	....	...	780	79	2005	192	1525	181	133
	75‡	1:7	112½‡	....	...	689	68	....	...	...	...	?
	80	1:8	None	575	100	663	100	705	100	715	100	100
	81‡	1:8	22½‡	837	145	758	114	1085	154	1230	172	141
	82‡	1:8	45‡	..	..	989	149	900	127	810	113¼	134
	83‡	1:8	67½‡	...	..	774	116	1240	176	1115	156	141
	84‡	1:8	90‡	...	...	617	93	1140	162	955	133	120
	85‡	1:8	112½‡	...	.	708	107	1215	172	970	135	128

Note.—* indicates that percentages were not used in computing averages.
† indicates hydrated lime.
‡ indicates lime putty.
All strengths are average of 5 tests.

Table 2. Effect of lime on 28-day compressive strength

	Marked.	Proportion Cement to Aggregate.	Lime per Sack of Cement, pounds.	Absorption by 24 Hour Immersion, per cent.	12 inches of Water Impounded on Face for 24 Hours.		
					Absorption, per cent Dry Weight.	Per cent of Impervious Units.	Penetration of Dampness, inches.
Hydrated Lime Series	60	1:6	None	5.96	3.12	40	3
	61†	1:6	10†	6.55	2.65	80	2½—3
	62†	1:6	20†	6.03	2.22	100	2½
	63†	1:6	30†	7.00	2.27	100	2 —2½
	64†	1:6	40†	7.79	2.45	100	2
	65†	1:6	50†	7.25	3.09	100	1½
	70	1:7	None	6.67	3.46	20	4
	71†	1:7	10†	7.13	3.64	100	3½—4
	72†	1:7	20†	7.46	3.20	100	3 —3½
	73†	1:7	30†	7.63	3.35	100	2½
	74†	1:7	40†	5.90	3.28	100	2
	75†	1:7	50†	6.02	2.04	100	1½
	80	1:8	None	5.97	3.11	60	3½—3
	81†	1:8	10†	6.52	3.65	80	3 —3½
	82†	1:8	20†	6.57	3.78	100	3
	83†	1:8	30†	6.12	2.26	100	2½
	84†	1:8	40†	6.28	2.47	100	2 —2½
	85†	1:8	50†	7.14	3.05	80	1½
Quicklime Putty Series	60	1:6	None	5.96	3.12	40	3
	61‡	1:6	22½‡	5.60	2.21	60	2½—3
	62‡	1:6	45‡	6.25	2.31	100	2½
	63‡	1:6	67½‡	6.98	3.13	100	2
	64‡	1:6	90‡	6.87	2.33	100	1½—2
	65‡	1:6	112½‡	5.87	2.68	100	1½
	70	1:7	None	6.67	3.46	20	4
	71‡	1:7	22½‡	5.90	2.36	80	3
	72‡	1:7	45‡	6.08	2.36	100	2½
	73‡	1:7	67½‡	7.00	2.90	100	2 —2½
	74‡	1:7	90‡	6.60	2.76	100	2 —2½
	75‡	1:7	112½‡	8.37	3.58	100	1½
	80	1:8	None	5.97	3.11	60	3½—3
	81‡	1:8	22½‡	6.54	3.02	100	4 —4½
	82‡	1:8	45‡	5.96	2.65	100	3½—4
	83‡	1:8	67½‡	6.75	3.72	100	3 —4
	84‡	1:8	90‡	6.99	3.50	100	3 —3½
	85‡	1:8	112½‡	7.77	4.10	100	1½

Note.—† indicates hydrated lime.
‡ indicates lime putty.
All values are the average of 5 tests.

Table 3. Effect of lime on absorption, permeability and dampness penetration. Result from blocks tested as made in Cedar Rapids Plant

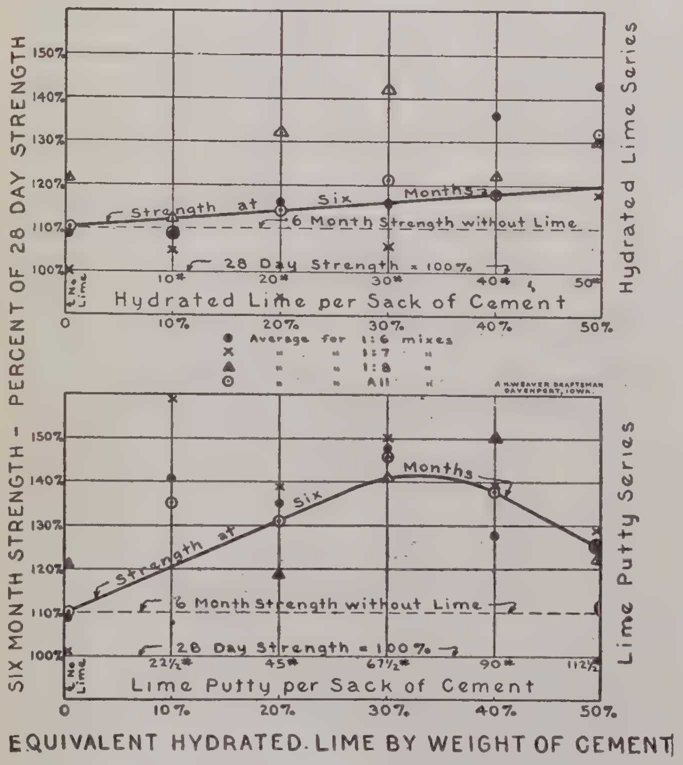


Fig. 2. Effect of lime on compressive strength after 28 days

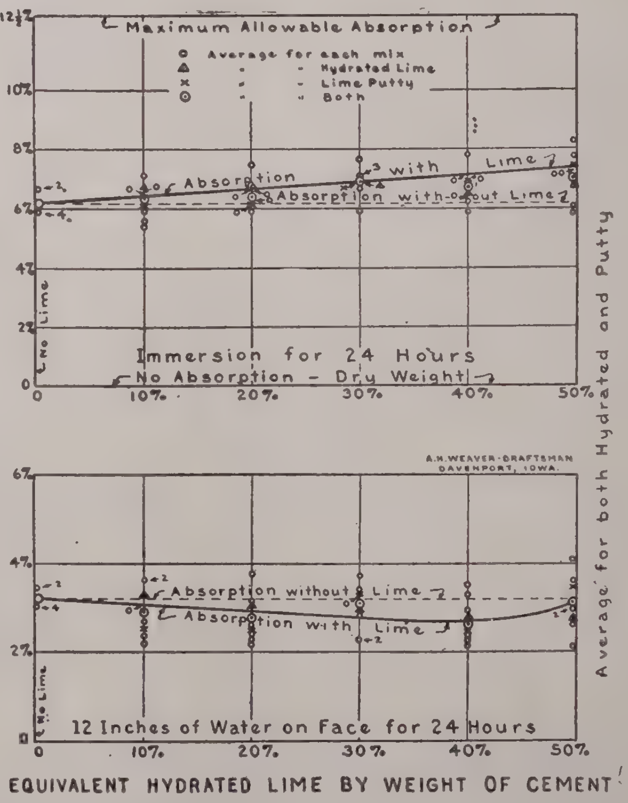


Fig. 3. Effect of lime on absorption

Pipe Manufacturers Meet in Chicago

The American Concrete Pipe Association is co-operating with other interested organizations to the end that standard specifications may be ultimately adopted for the manufacture of reinforced concrete culvert pipe and reinforced concrete sewer pipe.

A discussion of the submitted tentative standard specifications for these two items received a great deal of consideration at the annual convention of that association held in Chicago on February 22 and 23. The members of the organizations are devoting a great deal of attention toward the manufacture of the best possible pipe that may be economically and feasibly produced, and are considering further laboratory investigations to throw new light upon the possibilities.

The opening session of the convention was begun with a report from Paul Kircher and C. F. Buente, representatives on the Joint Concrete Culvert Pipe Committee, who submitted tentative standard specifications for reinforced concrete culvert pipe. These specifications were discussed exhaustively by the members present, and a resolution was finally passed to receive and approve the report and refer it back to the committee for further report at the next annual meeting, after further tests have been made.

The tentative standard specifications for reinforced concrete sewer pipe of the American Concrete Institute, as adopted in 1925, were then brought before the organization, the discussion resulting in a number of recommendations being made to the responsible committee to further carry on this work for the formation of standard specifications.

In the afternoon, Mr. G. H. Redding, president, reviewed the work of the association during the past year, and gave several reasons why the organization has undertaken its current work at the right time. Following his address and the report of the secretary and of the treasurer, Mr. R. A. Foley, of Detroit, Michigan, read a paper on the subject of "Manufacturing and Sales Problems." Mr. Foley, who is sales engineer of the Superior Sand and Gravel Company, Detroit, described the experiences of that company on the design of concrete mixtures, the use of the centrifugal process in manufacturing pipe, the application of fineness modulus to the design and manufacture of pipe, and reported the results of the current research work being carried on by his concern.

The second day's session opened with a discussion on the application of the design of concrete mixtures in the manufacture of concrete pipe. This discussion, lead by R. D. Robertson, concrete engineer, Independent Concrete Pipe Co., Indianapolis, Indiana, brought out a great many points of interest to every pipe manufacturer. After admitting the difficulties of forming standard test cylinders by which the present strength of concrete in pipe may be determined, an idea was advanced that promised to prove quite feasible. The manufacture of a special six-inch pipe with the same wall thickness as used in the large pipe under consideration was suggested. These small pipe could be easily made by the centrifugal process or any other process, in accordance with the prevailing practice in any plant, and would probably come nearer to presenting true conditions than would the standard compression cylinder.

After the business meeting, the following officers were nominated and elected to serve during the coming year: President, R. S. Lander, Shearman Concrete Pipe Co., Little Rock, Arkansas; secretary, M. N. Loving, Portland Cement Association, Chicago; treasurer, Geo. E. Warren, Portland Cement Association, Chicago; vice-presidents: E. F. Bent, Los Angeles; F. H. Ahrans, Ampere, New Jersey; C. F. Buente, Pittsburgh, Pennsylvania. Executive committeemen: C. E. Edwards, Grand Rapids, Mich.; N. A. Eppes, Houston, Texas; G. G. Robinson, Toronto, Ontario; C. H. Bullen, Portland, Oregon. Following the election the new officers were installed.

The final session of the convention was held on Tuesday afternoon, and was devoted to three very interesting papers. The first was by R. V. Fletcher of the Illinois Central Railroad on "The Accomplishments of the Railroads During 1925 and What Is in Store for Them in 1926." Another important address was delivered by I. L. Simmons, bridge engineer, Rock Island and Pacific Railroad. The closing paper by G. L. Fugate, Houston, Texas, was devoted to the subject of "The Relation Between the Manufacturer and the Engineer." These constructive and inspirational talks were of real value to everyone who heard them.

The convention wound up with the annual dinner and smoker held in the Bal Tabarin of the Sherman Hotel.

A Chance To Save Money

How often have you, Mr. Contractor, been stuck out in the woods with nothing but an indifferent highway or a single-track railroad, sadly taxed by other traffic, to afford delivery of all your materials? Those who have tried it say that the problem of supply is no easy one to solve. Often one material must be held down the line to let another material be delivered, and at the best the job may be slowed down considerably. We have heard of how at least one contractor, similarly situated, solved this problem, and we are passing it along for what it may be worth.

When brick or tile were hard to obtain in sufficient quantity, and when freight rates were eating up profits on the work, this man simply imported a concrete brick and tile machine, ordered a little extra cement, and made his own materials right on the job. Since then, whenever possible, he made his own brick and tile whenever operating in a section not already supplied by an established reputable products manufacturer. Other contractors are finding the proposition of manufacturing drain and sewer tile on the job a simple and advisable matter, especially when aggregates can be secured on the work and when finished products, of clay or concrete, can not be shipped to the work economically.

New Dams Projected for Mexico

A contract has been entered into between an electric power company and the Mexican Government fixing the terms of a concession granted that company for the use of the Conchos River for generating hydro-electric power, Consul Thomas McEnelly, Chilhuahua, reports to the Department of Commerce. The present contract supersedes those entered into with this company on December 8, 1909, August 8, 1910, and January 3, 1912. The present contract authorizes this firm to construct the following: (1) A dam 70 meters high on the Conchos River to impound the waters of this river to the extent of 1,019,000,000 cubic meters. (2) The necessary hydraulic works to provide power, in connection with the above mentioned dam. (3) To construct a dam and the necessary hydraulic works to utilize water for power up to 50,000 liters per second as a maximum of the waters of the Rio Conchos. The duration of this concession will be for 85 years beginning December 10, 1909.

Does your bank balance check with your bookkeepers' records? A good cost-finding system is worth twenty clerks, and it tells the truth about your income,—to you.

Convention of the Concrete Products Association

In accordance with the plan decided upon a few months ago, delegates to the 1926 Convention of the National Concrete Products Association spent the morning of February 25 attending the session of the American Concrete Institute on technical aspects of concrete products. The Convention was held in the Sherman Hotel, Chicago. Following the complimentary luncheon tendered to the members ot the American Concrete Institute by the Blaw-Knox Co., the Products Convention convened in separate session.

The session opened with an address by S. I. Crew, acting president, in which he formally notified the members of the association of the death of their former president, W. H. Carey. Mr. Crew dealt at some length upon the great service which Mr. Carey had rendered both the industry and the Association, and of the way in which he had conscientiously attended the affairs of the Association as long as he was able to take care of any business at all.

Following the address by Mr. Crew, A. J. R. Curtis of the Portland Cement Association delivered a talk on fire insurance rates on concrete masonry structures. He reviewed the work that has been done by the Portland Cement Association and the Concrete Products Association to secure more favorable rulings on the part of the underwriters, and made a careful analysis of the situation as it stands at present. He presented to the Association a plan which has been worked out with the Underwriters' Laboratories to make available the label of that body for use on the products of manufacturers who could comply with its standards.

A representative of the Underwriters' Laboratories was present to explain the basis on which the cooperation was offered, and after considerable discussion the Convention expressed itself as in favor of the plan, provided the details of it could be worked out on a practical basis.

The second paper presented was by Austin Crabbs on the subject of economical plant operation. He pointed out that the average concrete products plant has grown from a modest beginning without any particular planning on the part of the owner, with the result that its arrangement is often not the best for the economical production of block and tile. He suggested that in many cases a rearrangement was well worth the expense, and predicted that the products plant of the future would be designed on the same principles of efficiency as are factories of any other type. Mr. Crabbs placed particular emphasis on the element of distance as an item of cost in the handling of products within the plant, and pointed out that the greatest savings that could possibly be effected in an operation generally came from the shortening of distances over which aggregates or completed blocks had to be moved.

The high point of the session was the discussion which followed D. R. Collins' talk on the promotional value of a good building code. Mr. Collins pointed out the advantages which had been secured by the Concrete Products Manufacturers of Wisconsin as the result of a fair and enforceable set of building regulations. Stabilization of the products market and the development of confidence on the part of the buyer were the two outstanding advantages, in Mr. Collins' opinion, but he also placed great stress upon the advertising value that could be developed by a proper use of the code requirements.

The discussion which followed Mr. Collins' talk centered about a proposal made by Mr. Crew that the Association formulate a standard building code regarding the use of concrete products. There was no general agreement as to what the most advisable code requirement for the compressive strength of block or tile might be. It was generally conceded by all present that a compressive strength of 700 pounds per square inch of gross area would be ample provision for any stresses which concrete block or tile are called upon to sustain, but some of the manufacturers present seemed to feel that there was a distinct advantage in having a standard considerably higher than this to advertise to the building public. The discussion closed with the appointment of a committee by Mr. Crew to consider and report on the advisability of formulating a general set of code standards on concrete products.

The second day of the Convention was devoted to subjects pertaining to sales and advertising problems, and opened with a talk by John E. Powers on "Successful Sales Methods." Mr. Powers' talk was the result of his long and successful experience in the concrete products field and allied building industries.

Among the various suggestions which Mr. Powers made to products manufacturers was the diversification of their line of products when they find that their market for blocks is not large enough to keep their plant going at a sufficient capacity to maintain economical production. Concrete fence posts, roof tile, and trim stone were among the things which Mr. Powers suggested as suitable additions to the line of products manufacturers located in towns of 10,000 population or less.

Following Mr. Powers' talk, C. O. Goehnauer of Appleton, Wisconsin, gave a talk entitled, "Selling Material for Factory Construction," in which he discussed in a comprehensive way the various advertising and selling ideas which he has developed in marketing his output.

The balance of the session was given over to a talk on direct mail advertising, by E. S. McGowan, and a discussion of freight rates in their application to concrete products by F. E. Guy, of the Universal Portland Cement Company. Mr. McGowan displayed before the Convention a number of pieces of direct mail advertising which had proved peculiarly successful for the men who used them. Mr. Guy pointed out the various problems that arise when an attempt is made to secure a favorable freight rate on concrete products, and made various suggestions as to how these problems could be met to best advantage by manufacturers who are desirous of extending their marketing territory. His talk made a considerable impression on the members of the Association, and as a result a committee was appointed with E. W. Dinehart as chairman to consider the subject and report further on it.

The Board of Directors of the Association was increased from seven to fifteen members, and at the meeting of the new board which followed the Convention, John E. Powers of Sterling, Ill., was elected president for 1926; S. I. Crew of Cincinnati, first vice-president; Newton Benson of Providence, R. I., second vice-president; D. R. "Spec" Collins, secretary, and Jacob Bosch of Chicago, treasurer. The Executive Committee consists of Mr. Powers. Austin Crabbs of Davenport, D. R. Collins, George Saffert and A. G. Swanson.

Expanding the Concrete Products Market

The Products Man Must Sell Himself and His Own Men Before Selling the Builder — Dress Up the Plant — Sell Construction, Not Blocks — Advertise Your Products

By JOHN POWERS
President, Illinois Concrete Products Association, Sterling, Ill.

John Powers' message is an important one to the products manufacturer. In his own expressive and forceful way he gave it, pretty much as written here, before the recent annual convention of the Wisconsin Concrete Products Association, in Milwaukee. John Powers is a successful man. His products plant is nothing to be sneezed at. And then he finds time to run a number of other manufacturing concerns, and work for the local Chamber of Commerce as well. He knows what it means to create markets and to so merchandise his organizations that they show a consistently good profit. The things he says here are things that he has learned from experience. They are almost a sure guide to financial success. He knows that a man must sell himself on his product before he can sell to others. We can do no better than to let John Powers tell his own story—as only he could tell it.— ***The Editors.***

To begin with, to expand your market, you must sell your proposition to yourself. Convince yourself beyond any question of doubt that you are making the very best blocks being made or sold anywhere. Prove this by getting an association test made every three or four months. Hang up your test certificate. Then go forth and tell the world. Blast it into them from every angle. Now, having sold your proposition to yourself so that you have unlimited faith in it, commence right there in the factory and sell it to every man connected with your firm. Drill it into them if it can be done. If not, "can" them and get men on the job who have faith in your proposition. Then start right from there and spread the news.

Your next job will be to sell yourself and your product to your community. In selling yourself to your community it is necessary to get in on your local boosting organization, Association of Commerce, Merchants Association or whatever the organization happens to be. Be a mixer! One of the leaders! Remember that about ten per cent of the men of any community shape the policies of that community. They carry most of the load and get nothing for it. But, I know from experience its mighty good advertising. Join the Concrete Products Manufacturers. Subscribe to about eight or ten trade journals. When they come, read them from cover to cover, advertising and all. You will find something of great value in each number. Then carefully file each number where you can get it for reference. Keep in close touch with the Portland Cement Association. They will send you thousands of dollars worth of information each year, coming to you in the form of bulletins almost daily, showing you just exactly what is the latest in construction and manufacturing methods throughout the whole world, at no extra cost to you. Attend the conventions and get around and see what the other fellow is doing. If you do this, I know you are going to have faith in your proposition. You won't go very far until you realize that you are engaged in manufacturing a mighty essential construction unit. Have a nice clean office, with a neat exhibit of your products set up in suitable surroundings.

Clean House

Now let's go back to the plant. Clean up the yard, the whole property. Don't have a broken brick or block anywhere around the place. Bust them up and use them over again at once. Clean up the plant inside and out. Give your products a chance. Did you ever see a clay brick exhibit thrown in a loose pile? Pile your stock pile level plumb and square and neatly. Remember your principal customers are men with a mechanical eye, contractors. This I know because I have been wearing contractors shoes for forty years. They take in all of the surroundings at a glance. Appearances count with them. They are planning a building of some kind or they would not be there. They came to your place to try to find something in your yard to build with. Give them a chance to see your stock at its best! Don't have any junk or rubbish to attract their attention. This is the man you spent your advertising money to bring in. He has arrived. Get to work on him. Try everything you know about salesmanship. Be prepared, so that you won't be handicapped. Try and get his viewpoint and get on his side of the fence. Be loaded with circulars and data, photographs and plans of houses, factories and garages. In fact, be prepared to do business. And I would suggest here, that you let him give you his ideas first. Then with the data and plans and publications in your office help him to work out a workable plan. In doing this, remember all the while that you are gaining this man's confidence. You have landed him, when he is in a receptive state of mind. You have been able to help him plan his job and while you are talking to him you are loading up with a lot of good information, that you are going to be able to use to advantage later on.

Work With Him

For instance, see that the floor plan of the building provides for a good substantial footing. And that the excavation is wide enough so that the mason can point the joints up on the outside so that the wall can be waterproofed on the outside if necessary. Know the cost per cubic foot of this footing. Sell him the concrete mixed. Then sell him the blocks for the foundation. You must know the cost per square foot of this foundation in place, and you must know the comparative cost of any other foundation in place. Remember, you are selling him not blocks, but square feet of wall at so much per square foot. Sell him four-inch tile for partition walls. Sell him chimney brick and cistern brick.

Show your customer a poured wall costs, forms and all, from forty-five to sixty cents a square foot. No test on it, no air spaces and a green wall. It won't be concrete for thirty days. While you can sell him a concrete block foundation wall in place at thirty-five cents a square foot, every unit is a standard unit, as hard as flint and he can start building on it in ten minutes. You are saving him twenty per cent on the cost and ten days or two weeks time.

Show Him Savings

Now you are ready to start selling him the house. You must have the data there, where you can show it to him and right here I want to call your attention to the need of a private office. All of this conversation and all of this data and these plans must be handled in your office free from interruption of any kind. Show him the cost of the concrete block wall, stuccoed on the outside, furred and plastered on the inside as against the brick of the same construction. The comparative cost of brick veneer. The comparative cost of frame. You can beat them all. Be prepared to prove it. Then keep right on proving it. There is a lot to be said for your product. Say it. Don't talk about the weather. Talk about concrete. Then build something using concrete entirely. Use metal lath, no wood lath, metal sash and re-inforced concrete roof or cement shingles.

Build an all concrete garage for yourself and some of your neighbors, with a cement tile roof. Use metal trusses and angle irons to support the shingles, no wood. Haul the blocks to the job, pile them in a neat square pile and put a sign on the pile telling whose blocks they are and what you are going to do with them.

In this day of the automobile that sign will spread the news very shortly. Remember when you are selling these concrete units to your customer you are selling him the best existing building unit now being sold. Prove it to him. The cement association will furnish you the absolute proof for the asking. It don't cost him or you a cent. And remember you are selling all of this at the cost of frame construction. And it doesn't stay that way but improves with age. You will be saving that man money every year hereafter. Two per cent on paint, three per cent on depreciation, five per cent on insurance and ten per cent on his fuel. Each and every year, and at least twenty-five per cent in satisfaction.

Sell Other Items

But you are not through with him yet. Sell him metal lath for the whole house. Sell him plaster, corner beads, his cement walks, the garage with the cement roof and floor. Sell him a drive to garage. In other words, sell him your whole line. No lumber, the lumber yards sell lumber. But you are the cement and concrete man of the community, if there is such a man.

Now advertise, right directly at the man you want to reach. First write him, inclosing circulars or whatever he happens to need. Then see him and sell him. Then once you have a customer write him at least once a month inclosing any printed matter that would be of interest to him. Go to his job and help him in a pinch. In other words hold him. Put him under obligation to you. Get acquainted with all of his men. Some of them may be contractors next year. Sell your proposition to each and every one of them. Paint everything you own at least once a year. Especially your buildings and trucks, lettering them. This is the very best advertising. Put a big sign on every job. But follow up this advertising by going after the business. And go after it hard, the go-getters are getting the business now-a-days. Business is like a wheel-barrow, somebody must push and steer it, or it won't move. That's your job. If you are going into this business jump in all over or stay out. There is a reasonable profit in it, if you use horse sense and tend to business and if you do not you will go broke no matter what you are in. Honesty pays. Be honest with yourself. Don't kid yourself. You can't kid anyone else and win.

TAKE OFF YOUR COAT

Somebody said that it couldn't be done
But he with a chuckle replied
That maybe it couldn't, but he would be one
Who wouldn't say so till he tried;
So he buckled right in with a trace of a grin
On his face. If he worried, he hid it;
He just started to sing as he tackled the thing
That couldn't be done, and he did it.

Somebody scoffed: "Oh, you'll never do that;
At least no one has ever done it."
But he took off his coat and he took off his hat
And the first thing we knew he'd begun it.
With the lift of his chin, and a bit of a grin
Without any doubting or quiddit
He started to sing as he tackled the thing
That couldn't be done and he did it.

There are thousands to tell you it cannot be done;
There are thousands to mock and to rail you;
There are thousands to point out to you one by one
The dangers that lurk to assail you;
But just start right in with a sort of a grin;
Then take off your coat and go to it.
Just start in to sing as you tackle the thing
That cannot be done, and you'll do it.

German Firm Gets Dublin Housing Contract

The Dublin City Commissioners announce that a contract for the erection at a cost of £119,000 of 230 concrete dwelling houses in connection with the Marine Housing Scheme has been awarded to a German firm which is expected to commence work immediately, Consul H. M. Collins, Dublin, advises the Department of Commerce. A provision of the contract is that Irish materials and labor shall be utilized as far as may be possible.

The tender of a Dublin builder for the erection of 218 five-room houses in connection with the Keogh Barracks dwelling house project has been accepted, the amount involved being £105,600. Drainage and sewerage undertakings, projected by the City Commissioners for commencement in the near future aggregate £152,000.

Many a man has been generous with his materials,—and even with his water,—only to find that the owner didn't appreciate the liquid part of his generosity.

Water may wash away the sins of the world,—but some fellows use it to wash away their cement as well.

Pointers on Patents

The Inventor Is Able to Patent a Process, An Article, and a Design and Thus Obtain Threefold Protection Based on a Number of Claims—What Patent Rights Mean—Infringement

By LEO T. PARKER
Attorney at Law, Cincinnati

Patents may be obtained on Machines or Improvements, Articles of Manufacture, Composition of Matter, Mechanical Processes, Chemical Processes and Designs. All patents, except designs, issue for 17 years. A design patent issues for 3½, 7 or 14 years, as the applicant may elect, and relates to the exterior appearance of an article which must be novel, ornamental and attractive to the eye.

A process patent relates to a new and advantageous method of accomplishing a purpose. The rules by which process patents are governed differ considerably from the rules of machine or articles of manufacture patent. A process patent is issued on the steps necessary to make a thing or produce a result, whereas a machine or article patent relates to the thing produced. Therefore, if a new article is produced by a new method the inventor may obtain at least two patents, one on the thing itself and another on the method or process by which it is produced. A design patent may, also, be obtained on the same article, if it is ornamental.

If an invention is protected by an article of manufacture, process and design patent, an infringer of either of the patents is liable to the patentee for the damages, profits and under certain conditions, for punitive damages which may amount to three times the actual damages.

Process Patent Strongest

Of the article, process and design patents, a process patent probably is the strongest, because even if the order of the steps enumerated in the patent are changed or rearranged infringement exists just the same as when the general aspects of the process are followed. Sometimes, however, a rearrangement of the steps to produce a thing may effect decided new and useful results in which event the inventor of the new arrangement may obtain a patent on his process, but even then he may not be permitted to use it, if the claims of the first patent broadly covers the new process.

In the case of an infringement of any patent, the patentee may obtain an order from a court known as "preliminary injunction" restraining and commanding an infringer to discontinue making, using and selling a patented product, providing the character of infringement is so plainly evident that it is not necessary to prove the case in court. However, such an order is rarely issued until after the patent is adjudicated, that is, pronounced valid by the courts.

An important thing to know is that it is not necessary to notify an infringer to discontinue the infringement before bringing a suit providing the goods are properly marked as "Patented (date)." Moreover, even if the product is not marked and no notification is given, the profits of the infringer may be sustained.

Heavy Penalties

Whenever a verdict is rendered sustaining an infringement, the court may, if it so desires, enter judgment against the infringer for three times the amount of the verdict of the "damages and profits," but the court rarely does this unless it is plainly shown that the infringer wilfully and knowingly infringed the patent. The damages are measured by a reasonable royalty basis from the date the patent is allowed; whereas the profits comprise the actual profits made by the infringer.

Many persons are wrongly of the belief that it is permissible for anyone to make a patented article for his own use but this is not true. No one, except the patentee has a right to make, sell or use the invention during the life of the patent.

Unenforceable Patents

However, no person can be held guilty of infringing a patent if anyone of the following matters are proved by the party being sued or prosecuted:

1. If for the purpose of deceiving the public the description and specification of the patent application contains less than the whole truth relative to the invention, or more than is necessary.
2. That the owner of the patent obtained the patent which was for a device actually invented by another person who was using reasonable diligence in perfecting the same.
3. That the invention was patented or described in some printed publication prior to the time the owner of the patent invented the device or published by the inventor more than two years prior to the time his application for a patent was filed.
4. That the patentee was not the original or first person to invent or discover the patented article.
5. That it had been in public use, offered for sale or on sale in the United States for more than two years prior to the time when the patentee filed his application for a patent.
6. That the invention had been given or abandoned to the general public.

Worth of a Patent

Another thing about which many persons are misinformed is relative to the actual worth or value of a patent from the standpoint of using it to prevent other persons from making the invention. A patent usually consists of drawings, specification and claims. The specification is the first portion of the reading matter and is a complete description of the invention. The claims are the last portion of the reading matter and are the important part or in other words the "heart" of a patent. The specification and drawings, for example, may contain a complete disclosure of a process for making a concrete block, but if the claims only enumerate the method of facing the block anyone else can make the block, as shown and described, provided the method of facing it, as described in the claims, is not infringed.

So, therefore, before it is possible to know whether or not any patent is infringed it is necessary to make an exacting comparison of the claims of the patent with relation to the particular article in question.

Any person who directly copies another device, not only will be liable as an infringer, but he may also be prosecuted under the statute of "unfair competition," which offense is even more serious than a mere infringement.

In other words the courts look with disfavor upon any individual or firm who attempts to palm off on the public merchandise which may be unintentionally purchased.

Adhesion of Gypsum Plaster to Concrete

At the request of the committee on gypsum of the American Society for Testing Materials, two short experiments have been carried out in conjunction with a study of the linear expansion of gypsum. From the results obtained in some previous work a number of conclusions were drawn. One conclusion reached was that if a particular gypsum mix had an expansion approximating that of a particular concrete, under the same conditions, that gypsum mix might be expected to have good adhesion to the concrete. If, on the other hand, the particular gypsum mix behaved in great variance with the concrete, that gypsum mix would probably not give as good adhesion to the concrete.

The first experiment carried out was to test some of the brands of calcined gypsum and the concrete used in the previous work to see what loss of adhesion they would show when subjected to humidity changes. The method of testing was to make up six half briquets of a particular 1:3 cement mix, and after the cement had set the other half of the mold was filled with the gypsum mix.

After the mortars had set the briquets were removed from the molds and allowed to dry in the laboratory for seven days. The strenght of the bond between the cement and the gypsum was then tested, three briquets being broken in the usual manner. The remaining briquets made from the various samples of gypsum were placed under water for five hours and then allowed to dry in the laboratory for seven days. The strength of the bond between the gypsum and the cement in these briquets was then tested as before.

The results of these tests showed that the brands of gypsum which gave expansion curves similar to the concrete gave good adhesion to concrete and a small loss only in adhesion when subjected to humidity changes. The brands of gypsum giving expansion curves in great variance with the curve for concrete showed poor adhesion values.

The second experiment carried out was a study of the linear expansion changes of a concrete and of the coats of plaster as they were applied to the concrete. The method consisted in making up a 2 by 4 by 12 inch specimens of 1:2:4 concrete. These specimens were fitted with two plugs made from capillary glass tubing, placed in the mortars 10 inches apart. Expansion readings were made from these plugs, using a 10-inch strain gauge. The concrete specimens were allowed to dry in the laboratory for 30 days, and then a one-half-inch coat of a 1:2 gypsum-sand mix was applied to the slabs. Short pieces of glass tubing were placed around the glass plugs in the concrete so that the expansion readings of the concrete were not affected. Another set of plugs was placed in the first coat before it set. Expansion readings were made hourly on the concrete for about 24 hours, after which a one-half-inch second coat was applied, using a 1:3 gypsum-sand mix. Before the application of the second coat short pieces of glass tubing were placed around the plugs in the first coat in order to avoid affecting the expansion readings of the first coat. A third set of plugs was placed in the second coat before it had set. Expansion readings for both the concrete and the first coat were made hourly for about 24 hours. Then a thin white finish coat of lime and gauging plaster was applied, and expansion readings for the concrete and first and second coats were continued for 14 days. It was found that the concrete has a relatively great expansion when the first coat is applied, less expansion when the second coat is applied, and a very small expansion when the third coat is applied. The first coat has a relatively great expansion when the second coat is applied, but only a small expansion when the third coat is applied, while the second coat shows only a small expansion when the third coat is applied.

Solvay Process Company Secures H. F. Clemmer

H. F. Clemmer, C. E., Chief of the Bureau of Materials of the Illinois Highway Division, has announced his resignation effective January 1st, to become associated with the Solvay Process Company (as technical adviser to the Calcium Chloride Sales Department). This announcement marks the loss from the ranks of State Highway Officials of one of the foremost testing engineers of the country.

Mr. Clemmer has for many years been identified with investigational and testing work of structural materials. He studied Civil Engineering at Iowa State College and after graduation spent several years on the staff at that institution and that of the Iowa Engineering Experiment Station.

Shortly after the enactment of legislation in Illinois, providing for the construction of concrete pavement under the sixty million dollar bond issue, Mr. Clemmer became Engineer of Materials of the Illinois Division of Highways and in this capacity has developed an organization of nationally known reputation. During this time he developed researches in concrete aggregates and curing methods with Calcium Chloride as well as studies in the physical properties of concrete, plain and reinforced, which have led to changes of design and developments of specifications of proved economic importance.

He had direct charge under Clifford Older of the investigational work carried on in the famous Bates Road Tests.

Mr. Clemmer is chairman of the non-bituminous section of the Committee on Tests and the Investigations of the American Association of State Highway Officials and of the sub-committee on Asphalt Content of the same organization. He is chairman of the committee on specifications and tests of fine and coarse aggregates of Com. C-9, and a member on the committee of admixtures, both of the A. S. T. M. In addition he holds membership in several other committees of this organization. Mr. Clemmer is also a member of the A. S. C. E., Am. Soc. for Municipal Improvements, and the American Concrete Institute.

Although he is leaving the ranks of highway officials, Mr. Clemmer expects to keep in touch with research in highway design and materials and will carry on investigations in regard to curing of concrete and the use of Calcium Chloride in the laboratories of The Solvay Process Company.

Arrangements have been planned and perfected for conducting a survey of the projected road from Colon, Panama, to Nombre de Dios. Construction of the road, 50 miles long, may begin during the next dry season. Construction on the new Calidonia Road, an important street improvement in Panama City, has been finished and the road opened to traffic.

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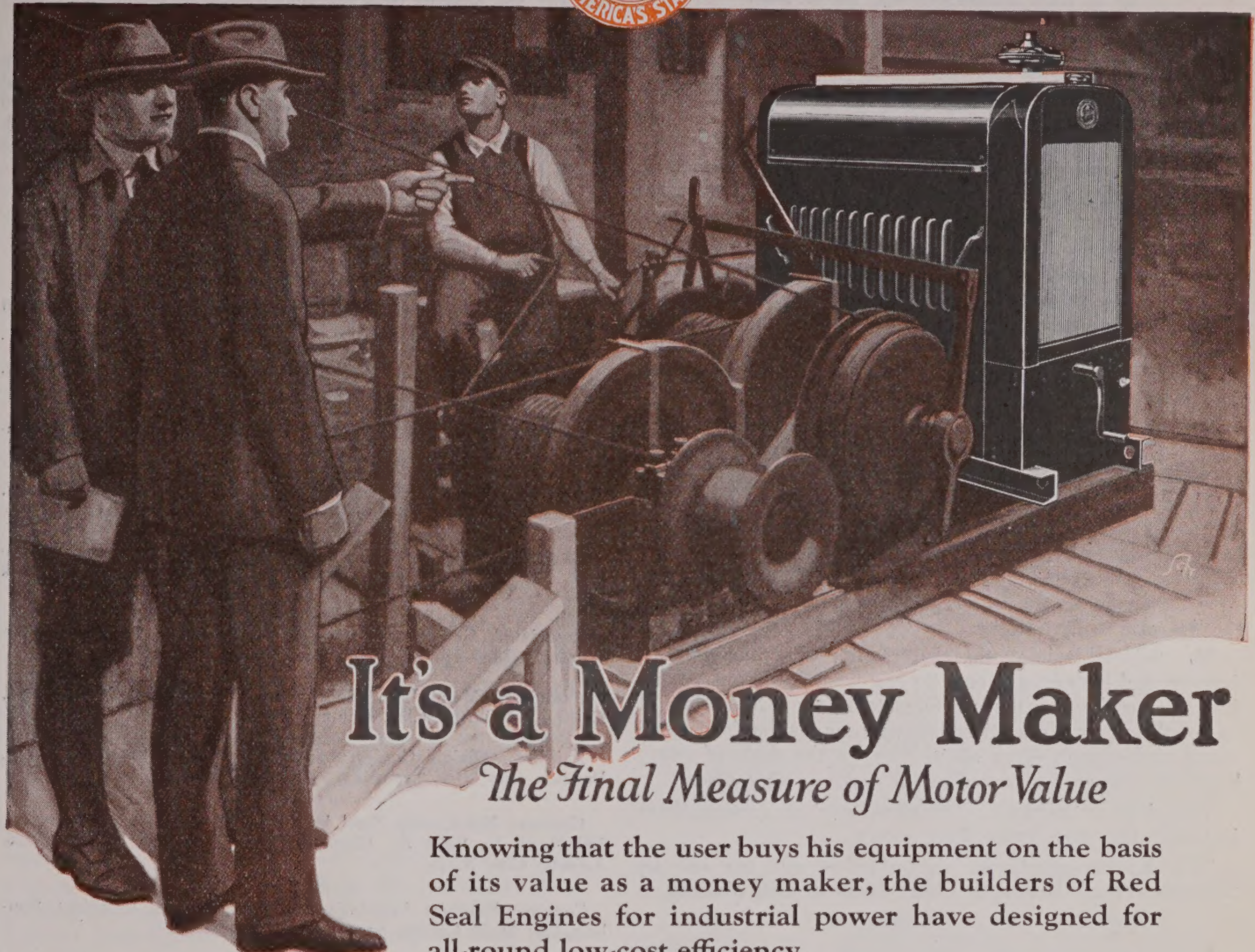

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New Books

"Die Kraftwagenstrasse" (Streets for Motor-Traffic), by Dr.-Ing. Rudolph Schenck

By E. LEE HEIDENREICH, Dr. of Engr.

This work in 133 pages, gives more sound information about the design and construction of streets and highways for motor traffic, than any one book as yet published in the English language—and it is to be hoped that an English translation soon will be available for the thousands of engineers and contractors engaged in spreading the ever increasing net of highways over the entire United States.

In his treatise, practically a handbook, Mr. Schenck covers, in a concise and practical manner, first the stresses caused by the motor vehicles on the pavements under the different conditions, then treats of the design and alignments required to meet the demands of the motor traffic, all based upon a thorough investigation of the pavement and road constructions up to date.

The American literature on the subject, while copious and full of details, is spread over scores of magazines, minutes of engineering societies, and recommendations of technical societies, and only available after long and tedious search. The author seems to be familiar with the latest experiments in materials, labor and complete construction of streets and highways in Europe from the Mediterranean to the Baltic, and in United States, from the Atlantic to the Pacific.

Mr. Schenck's book therefore, will be of the greatest interest and benefit, not only to engineers and contractors, but also to the industries interested in the production of automobiles, tractors, tires as well as asphalt, crushed stone and cement—and should be on the desk of every highway commissioner and maintenance-of-way officer.

The slogan, "via-vita"—"Where there is a road, there is life"—has more truth than poetry.

"Die Kraftwagenstrasse" is published and for sale by "Zementverlag," Berlin, in either linen or stiff binding.

Trade Publications

"Proceedings of the Eleventh Annual Conference on Highway Engineering," a bulletin of the College of Engineering, University of Michigan, Ann Arbor, New Series Vol. XXVII, Number 24, contains the complete minutes of the highway conference held last February at that University. The contents, of interest to engineers in the highway field and those interested in other branches of concrete construction, include papers and discussions on constructing and maintaining concrete pavements, the design of concrete pavements, disintegration of concrete, the properties of aluminate cements, methods of sampling gravel, snow removal, and other topics of real interest.

"Researches in Concrete," by W. K. Hatt, is the title of Bulletin No. 24 of the Engineering Experiment Station, Purdue University, LaFayette, Indiana. In this bulletin is not only an account of the researches in concrete undertaken in the laboratories of that university, but summarizes in a complete fashion the work of other investigators throughout the world. A foreword reviews the general development of concrete research. A selected bibliography is appended. Topics reviewed include expansion and contraction, strength of dry and wet hardened concrete, extensibility, elasticity, plastic flow, permeability, fatigue, heat transmission, fire resistance, permanence of steel, reinforcing steel and bond, effect of age, amount of mixing water, time of mixing, field control, standard tests, field vs. laboratory tests, soundness tests of coarse aggregates, screenings as fine aggregate, and the relation of research to construction. For probably the first time, in this concise report, are assembled the many reports of various investigators in such a manner that the essential properties of concrete may be readily studied by the busy man. It is worth the attention of every reader.

"Reinforced Concrete Wall Footings and Column Footings," by Arthur N. Talbot, otherwise known as Bulletin No. 67, University of Illinois, is a new reprint of a very worthwhile text issued some time ago by that university and now again available for purchase. This bulletin gives an account of tests carried on at the laboratory of the Engineering Experiment Station of the university prior to the war, and presents facts that should be well considered by every designer.

Statistics gathered by the Bureau of Mines, Department of Commerce, show that the production of calcium chloride from mineral raw materials in 1924 exceeded $1,1000,000 in value and 58,000 short tons in quantity. Further figures on salt, bromine, and calcium chloride in 1924 are contained in a pamphlet of that name issued by the United States government.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit.

American Concrete Pipe Association; M. W. Loving, Secretary, 111 West Washington St., Chicago.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 West Thirty-ninth St., New York City.

American Road Builders' Association; Wm. H. Connell, President, Miss E. A. Birchland, Secretary, 29 W. 39th St., New York City.

Associated General Contractors of America; D. H. Sawyer Secretary, 1038 Munsey Bldg., Washington, D. C.

Associated Metal Lath Manufacturers; 123 West Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference; Frank Burton, President, J. F. Downey, City Hall, Cambridge, Mass., Secretary.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, 160 North La Salle St., Chicago. Annual meeting, March, 1926, Atlantic City, N. J.

Concrete Products Association; John E. Powers, President, Sterling, Ill.; D. R. Collins, Secretary, Milwaukee, Wis.

Mid-West Concrete Products Association; D. R. Donlen, Secretary-Treasurer, 4340 Marcy St., Omaha, Neb.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

National Association of Building Trades Employers; A. E. Coleman, President, 37th St. & Stewart Ave., Chicago. A. W. Dickson, Executive Secretary, 214 Electric Bldg., Cleveland, Ohio.

National Association of Builders' Exchanges; William F. Chew, Baltimore, President; Earl F. Stokes, Secretary, 15 East Fayette St., Baltimore, Md.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East Twenty-second St., New York City.

National Sand and Gravel Association; 903 Munsey Bldg., Washington, D. C.

The National Lime Association; Burton A. Ford, Secretary, 918 G. Street, N. W., Washington, D. C.

Portland Cement Association; William M. Kinney, General Manager, 111 West Washington St., Chicago.

Wisconsin Concrete Products Association; A. P. Kuranz, Secretary-Treasurer, 425 E. Water St., Milwaukee.